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Occupational Safety and Health Administration

■

WALKING-WORKING SURFACES

Proposed Occupational Safety and Health Administration

DEPARTMENT OF LABOR

Occupational Safety and Health Administration

[29 CFR Part 1910]

[S–73–8]

WALKING-WORKING SURFACES

Occupational Safety and Health Standards

Pursuant to section 6(b) of the Occupational Safety and Health Act of 1970 (29 U.S.C. 655), Secretary of Labor's Order No. 12–71 (36 FR 8754), and 29 CFR Part 1911, it is hereby proposed to amend Part 1910 of Title 29, Code of Federal Regulations, by revising Subpart D thereof as indicated below.

Written comments concerning the proposed revision may be mailed to the Director, Office of Standards, Room 400 First Street N.W., Washington, D.C. 20210, before November 2, 1973. The comments received will be available for public inspection and copying at the Office of Standards at the address given above.

In addition, interested persons may file written objections to the proposed revision, or any portion thereof, and request an informal hearing with respect thereto, before November 2, 1973, in accordance with the following conditions:

1. The objections must include the name and address of the objector;

2. The objections must be postmarked on or before 1973;

3. The objections must specify with particularity the provision of the proposed revision to which the objection is taken, and must state the grounds therefor;

4. Each objection must be separately stated and numbered; and

5. The objections must be accompanied by a summary of the evidence which the objector purposes to adduce at the requested hearing.

The essential issues presented by the proposed revision represent the material differences between the present Subpart D and the proposed revision. The material differences are summarized as follows:

1. A policy is advanced to consider as de minimis violation of standards differences from structural and dimensional requirements when the differences are trifling and do not directly or immediately relate to the safety or health of employees. Experience with the standards since their effective date of August 27, 1971, suggests that there are many situations where there are such differences. Abatement of the differences in these situations may also be costly, and perhaps impossible for the employer when he lacks sufficient control of the premises.

2. Some changes in format are made in the subpart, which are intended to permit easier reading; e.g., increasing the number of section designations and placing relevant definitions closer to substantive requirements.

3. In the standards dealing with fixed industrial stairs, allowing for ship stairs as an acceptable means of going from one level to another under certain conditions.

4. The standards governing the specifications for standard railings are made more flexible, and provision is made expressly for accomodation of the requirements of the standards with the rules of other Federal agencies with different regulatory objectives.

5. Provision is made for the use of spiral stairs in the standards dealing with fixed industrial stairs.

6. In the case of scaffolding, some allowance is made for the use of safety belts and/or safety nets to be used in place of scaffolding guardrails, where the guardrails cannot be properly installed. Further, minimum plank spacing is specified, and changes are made in the wire gauge allowed for protection between guardrails and toeboards.

7. More explicit requirements are provided for a climbing ladder or stairway to be used with a manually propelled scaffold.

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§ 1910.21 Application.

(a) The substance of the standards which are published in this Subpart D reflect in large measure certain national consensus standards published by the American National Standards Institute (ANSI). The ANSI standards are the following:

(1) ANSI Z4.1–1968, Requirements for Sanitation in Places of Employment.

(2) ANSI A58.1–1955, Minimum Design Loads in Building and Other Structures.

(3) ANSI A12.1–1967, Safety Requirements for Floor and Wall Openings, Railings, and Toeboards.

(4) ANSI A64.1–1968, Requirements for Fixed Industrial Stairs.

(5) ANSI A14.1–1968, Safety Code for Portable Wood Ladders.

(6) ANSI A14.2–1956, Portable Metal Ladders.

(7) ANSI A14.3–1956, Safety Code for Fixed Ladders.

(8) ANSI A10.8–1969, Safety Requirements for Scaffolding.

(9) ANSI A92.1–1971, Standards for Manually Propelled Mobile Ladder Stands and Scaffolds.

(10) ANSI B56.1–1969, Safety Standard for Powered Industrial Trucks.

(11) ANSI B24.1–1963, Safety Standard for Forging.

(12) ANSI 01.1–1954, Safety Code for Woodworking Machinery.

(b) Subpart D was first published in the FEDERAL REGISTER on May 29, 1971 (36 FR 10469) and made effective August 28, 1971. Experience with the standards contained therein since that effective date have indicated many situations where there are structural and dimensional differences between the specific requirements of a particular standard and the actual practices of an employer. Many differences have been trifling, and in addition have had no direct or immediate effect upon the safety or health of employees. At the same time, however, the cost to an employer of literal compliance with such a standard may be disproportionately high. When these circumstances are present, any requirement for abatement is considered impractical, and perhaps not even feasible when an employer lacks sufficient control of the premises. Accordingly, in such circumstances, a notice of de minimis violation shall be issued in accordance with section 9(a) of the Act and Part 1903 of this chapter instead of a citation for a violation involved.

(c) The execution of the requirements of portions of this part may actually be carried out by persons other than the employer because of proprietary or contractual relationships. Nevertheless, the employer has a duty for the meeting of the standards. The standards are for the protection of his employees.

GENERAL

§ 1910.22 Scope.

This Subpart D applies to all permanent places of employment, except where domestic, mining, or where agricultural work only is performed.

§ 1910.22a Housekeeping.

(a) All places of employment, passageways, storerooms, and service rooms shall be kept clean and orderly to the extent that the nature of the work allows.

(b) The floor of every workroom shall be maintained in a clean and, so far as practicable, a dry condition. Where wet processes are used, drainage shall be maintained, and false floors, platforms, mats, or other dry standing places should be provided where practicable.

(c) To facilitate cleaning, every floor, working place, and passageway shall be kept free from protruding nails, splinters, holes, or loose boards.

§ 1910.22b Aisles and passageways.

(a) Where mechanical handling equipment is used, sufficient safe clearances shall be allowed for aisles, at loading docks, through doorways and wherever turns or passage must be made. Aisles and passageways shall be kept clear and in good repair, with no obstruction across or in aisles that could create a hazard. Permanent aisles and passageways shall be appropriately marked.

§ 1910.22c Covers and guardrails.

Covers, guardrails or some other means of equivalent effect shall be provided to protect employees from open pits, tanks, vats, and ditches, and similar openings presenting a hazard of falling, except as otherwise provided for in this subpart.

§ 1910.22d Floor-loading protection.

(a) The floor-loading capacity (the weight and distribution of safe loads on a floor) of each floor of a building on which an employee is working shall be determined by a registered professional engineer, architect, or other person who is qualified by training or experience to apply the scientific principles required to make the determination. The floor-loading capacity as so determined shall not be exceeded.

(b) The floor-load capacity determined under paragraph (a) of this section shall be marked on a sign made of durable material in easy-to-read letters. The sign shall be conspicuously posted on each floor. The sign shall be maintained in good condition.

(c) The requirements of paragraph (a) of this section do not apply when: (1) A floor is built on an earth (soil) base in a multi-floor building; (2) the building is of one-story construction, and the floor is at grade level, without cellar or basement with the total floor being supported by earth (soil base).

(d) The employer shall not exceed the floor-loading capacity determined under this section.

GUARDING FLOOR AND WALL OPENINGS AND HOLES

§ 1910.23a Purpose; definitions.

(a) *Purpose.*—(1) The purpose of the sections under the centerhead "guarding floor and wall openings and holes" is to protect employees working in areas where floor and wall openings present hazards to the safety of employees. The primary hazard is falling.

(2) The standards in the sections under the centerhead "guarding floor and wall openings and holes" shall not apply to industrial grating holes nor to the working face of floor openings which are occupied by elevators, dumb waiters, conveyors, machinery, piping, or containers; the loading and unloading areas of automotive truck and railroad docks, or platforms, scaffolds, pits and trenches and which are occupied for the purpose of providing access to a product, facility or process equipment while being worked upon.

(b) *Definitions.*—As used in §§ 1910.23b through 1910.23n the definitions contained in this paragraph shall apply.

(1) *Floor hole.*—An opening measuring more than 1 inch in its least dimension, in any floor, pavement, or yard, through which materials or tools may fall on persons or into machinery or equipment.

(2) *Floor opening.*—An opening measuring 4 inches or more in its least dimension, in any floor, platform, pavement, or yard, into which employees may step; such as a hatchway, stair or ladder opening, pit, or large manhole. Floor openings occupied by elevators, dumb waiters, conveyors, piping, machinery, or containers are excluded from this definition.

(3) *Handrail.*—A single bar or pipe supported on brackets from a wall or partition, as on a stairway or ramp, to furnish persons with a handhold in case of tripping.

(4) *Platform.*—A working space for persons, elevated above the surrounding floor or ground; such as a balcony or platform for the operation of machinery and equipment.

(5) *Runway.*—A passageway for persons, elevated above the surrounding floor or ground level, such as a footwalk along shafting or a walkway between buildings.

(6) *Railing.*—A vertical barrier erected along exposed edges of a floor opening, wall opening, ramp, platform, or runway to prevent falls of persons.

(7) *Standard strength and construction.*—Any construction of railings, covers, or other guards that meets the requirements of the sections under the centerhead "Guarding Floors and Wall Openings and Holes".

(8) *Toeboard.*—A vertical barrier at floor level erected along exposed edges of a floor opening, wall opening, platform, runway, or ramp to prevent falls of materials.

(9) *Stair railing.*—A vertical barrier erected along exposed sides of a stairway to prevent falls of persons.

(10) *Wall hole.*—An opening less than 30 inches but more than 1 inch high, of unrestricted width, in any wall or partition; such as a ventilation hole or drainage scupper.

(11) *Wall opening.*—An opening at least 30 inches high and 18 inches wide, in any wall or partition, through which persons may fall; such as an opening for a window, a yard-arm doorway or chute opening.

§ 1910.23b Stairway and other floor openings.

Every stairway floor opening shall be guarded by a standard railing constructed in accordance with § 1910.23n. The railing shall be on all exposed sides, except at the entrance to the stairway. Alternatively, the guarding may consist of a floor-opening cover of standard strength. In the latter situation, standard railings on all exposed sides (except at the entrance to the stairway) shall be used when the cover is removed and the stairway is in use.

§ 1910.23c Ladderway opening or platform.

Every ladderway floor opening or platform shall be guarded by a standard railing with a standard toeboard on all exposed sides (except at entrance to opening), with the passage through the railing either provided with a raising or swinging gate or chain or so offset that a person cannot walk directly into the opening.

§ 1910.23d Hatchway; chute floor opening.

(a) (1) Every hatchway and chute floor opening shall be guarded by one of the means prescribed in either subparagraph (2) or (3) of the paragraph.

(2) A removable or hinged floor opening cover of sufficient strength shall be provided. When cover is off and hatchway or chute is open, the opening shall be protected by a standard guardrail so as to leave only one exposed side. When the opening is not in use, the cover shall be replaced.

(3) A removable railing with toeboards on all sides of the opening shall be provided as required by the usage of the opening or a fixed standard railing with toeboards on all exposed sides. The removable railings shall be kept in place when the opening is not in use and shall preferably be hinged or otherwise mounted so as to be conveniently replaceable.

(b) Where operating conditions necessitate the feeding of material into any hatchway or chute opening, protection shall be provided to prevent a person from falling through the opening.

§ 1910.23e Skylight opening.

Every skylight opening shall be guarded by a skylight screen or a fixed standard railing on all exposed sides.

§ 1910.23f Pit; trapdoor floor opening.

Every pit and trapdoor floor opening shall be guarded whenever practicable by a floor opening cover of standard strength and construction which should be hinged in place. While the cover is not in place, the pit or trap opening shall be guarded by a person designated by the employer, or shall be protected on all exposed sides by removable standard railings.

§ 1910.23g Other floor openings.

(a) Every manhole floor opening shall be guarded by a standard manhole cover which need not be hinged in place. While the cover is not in place, the manhole opening shall be guarded by a person designated by the employer, or shall be protected by removable standard railings.

(b) Every temporary floor opening shall have standard railings, or shall be guarded by a person designated by the employer.

§ 1910.23h Floor holes.

(a) Every floor hole into which persons can accidentally trip shall be guarded by either:

(1) A standard railing with standard toeboard on all exposed sides, or

(2) A floor hole cover of standard strength and construction that should be hinged in place. While the cover is not in place, the floor hole shall be guarded by a person designated by the employer, or shall be protected by a removable standard railing.

(3) Every floor hole into which persons cannot accidentally walk (on account of fixed machinery, piping, equipment, or walls) shall be protected by a cover that leaves no openings more than 1 inch wide. The cover shall be securely held in place to prevent tools or materials from falling through.

§ 1910.23i Doors or gates opening on stairways.

Where doors or gates open directly on a stairway, a platform shall be provided, and the swing of the door shall not reduce the effective width to less than 28 inches.

§ 1910.23j Protection for wall openings and holes.

(a) Every wall opening from which there is a drop of more than 4 feet shall be guarded by one of the following:

(1) A rail, picket fence, half door, or equivalent barrier. (The guard may be removable but when the guard is removable it shall be hinged or otherwise mounted so as to be conveniently replaceable. Where there is exposure below to falling materials, a removable toeboard or the equivalent shall also be provided. When the opening is not in use for handling materials, the guard shall be kept in position regardless of a door to the opening. In addition, a grab handle shall be provided on each side of the opening with its center approximately 4 feet above floor level and of standard strength and mounting.); or

(2) Extension platform onto which materials can be hoisted for handling, which shall have side rails or equivalent guards of standard specifications.

(b) Every chute wall opening from which there is a drop of more than 4 feet shall be guarded by one or more of the barriers specified in paragraph (a) of this section, or such other guards as the conditions render appropriate.

(c) Every window wall opening at a stairway landing from which there is a drop of more than 4 feet, and where the bottom of the opening is less than 3 feet above the platform or landing, shall be guarded by standard slats, standard grill work (as specified in § 1910.23n(k)) or standard railing. Where the window opening is below the landing, or platform, a standard toeboard shall be provided.

(d) Every temporary wall opening shall have adequate guards but these need not be of standard construction.

(e) Where there is a hazard of materials falling through a wall hole, and the lower edge of the near side of the hole is less than 4 inches above the floor, and the far side of the hole more than 5 feet above the next lower level, the hole shall be protected by a standard toeboard, or an enclosing screen either of solid construction, or as specified in § 1910.23n(k).

§ 1910.23k Platforms and runways.

(a)(1) Every platform or runway six feet or more above an adjacent floor or ground level where an employee works shall be guarded by a standard railing (or the equivalent as specified in § 1910.23n) on all open sides.

(2) When the requirement prescribed in subparagraph (1) of this paragraph is not feasible because it would result in an impairment of the work being performed or because some accommodation is needed so that the rules of another Federal agency may be met, such as those of the U.S. Department of Agriculture under the Wholesome Meat Act (21 U.S.C. 601), alternative protection may be provided for employees which is as safe as that which would be afforded by § 1910.23k(a)(1).

(3) The guarding requirement in subparagraph (1) of this paragraph does not apply to the entrance to a ramp, stairway, fixed ladder, or ship stair.

(4) The railing required by § 1910.23k (a)(1) shall be provided with a toeboard wherever, beneath the open sides, a person can pass, there is moving machinery, or there is equipment with which falling materials could create a hazard.

(b) Runways used exclusively for special purposes (such as oiling, shafting, or filing tank cars) may have the railing on one side omitted where operating conditions necessitate such omission, provided the falling hazard is minimized by using a runway of not less than 18 inches wide. Where persons entering upon runways become thereby exposed to machinery, electrical equipment, or other danger not a falling hazard, additional guarding than those specified may be essential for protection.

§ 1910.23l Stairway and railing guards.

Regardless of height, open-sided floors, walkways, platforms, or runways above dangerous equipment, pickling or galvanizing tanks, degreasing units, and similar hazards shall be guarded with a standard railing and toeboard.

§ 1910.23m Stairway railings and guards.

(a) Every flight of stairs having three or more risers shall be equipped with standard stair railings or standard handrails as specified in subparagraphs (1) through (5) of this paragraph, the width of the stair to be measured clear of all obstructions except handrails:

(1) On stairways less than 44 inches wide having both sides enclosed, at least one handrail, preferably on the right side descending.

(2) On stairways less than 44 inches wide having one side open, at least one stair railing on the open side.

(3) On stairways less than 44 inches wide having both sides open, one stair railing on each side.

(4) On stairways more than 44 inches wide but less than 88 inches wide, one handrail on each enclosed side and one stair railing on each open side.

(5) On stairways 88 or more inches wide, one handrail on each enclosed side, one stair railing on each open side, and one intermediate stair railing located approximately midway of the width.

(b) Winding stairs shall be equipped with a handrail offset to prevent walking on all portions of the treads having width less than 6 inches.

§ 1910.23n Railing, toeboards, and cover specifications.

(a) *Standard railing.*—A "standard railing" shall consist of a top rail, intermediate rail, and posts, and shall have a

minimum vertical height of 36 inches to 42 inches nominal from the upper surface of the top rail to the floor, platform, runway, or ramp level. The top rail of the "standard railing" shall be smooth-surfaced throughout its length. The intermediate rail of the "standard railing" shall be about halfway between the top rail and the floor, platform, runway, or ramp. The end of the rails of the "standard railing" shall not overhang the terminal posts to the extent of causing a projection hazard.

(b) *Stair railing.*—A "stair railing" shall be of similar construction to standard railing, but the vertical height shall be not more than 34 inches nor less than 30 inches from the upper surface of the top rail to the surface of the tread in line with the face of the riser at the forward edge of the tread.

(c) *Various specifications.*—Minimum requirements for "standard railings" under various types of construction are specified in the following subparagraphs. Dimensions specified are based on the U.S. Department of Agriculture Wood Handbook, No. 72, 1955 (No. 1 [S4S] Southern Yellow Pine [Modulus of Rupture 7,400 p.s.i.]) for wood; ANSI G41.5–1970, American National Standard Specifications for Welded and Seamless Steel Pipe, for pipe.

(1) *Wood railings.*—For wood railings, the posts shall be of at least 2-inch by 4-inch stock spaced not to exceed 6 feet; the top and intermediate rails shall be of at least 2-inch by 4-inch stock. If top rail is made of two right-angle pieces of 1-inch by 4-inch stock, posts may be spaced on 8-foot centers, with 2-inch by 4-inch intermediate rail.

(2) *Pipe railings.*—For pipe railing, posts and top and intermediate rails shall be at least one and one-half inches nominal outside diameter with posts spaced not more than eight feet on centers.

(3) *Structural steel railings.*—For structural steel railings, posts and top and intermediate rails shall be of 2-inch by 2-inch by ⅜-inch angles or other metal shapes of equivalent bending strength with posts spaced not more than 8 feet on centers.

(4) *Anchors.*—Anchoring of posts and framing of members for railings of all types shall be of such construction that the completed structure shall be capable of withstanding a load of at least 200 pounds applied to the top rail horizontally.

(5) *Others.*—Other types, sizes, and arrangements of railing construction are acceptable provided they meet the following conditions:

(i) A smooth-surfaced top rail at a height above floor, platform, runway, or ramp level not less than 36 inches to 42 inches nominal;

(ii) A strength to withstand at least the minimum requirement of 200 pounds applied to the top rail horizontally;

(iii) Protection between top rail and floor, platform, runway, ramp, or stair treads, equivalent at least to that afforded by a standard intermediate rail;

(iv) Elimination of overhang of rail ends unless such overhang does not constitute a hazard; such as, baluster railings, scrollwork railings, panelled railings.

(d) *Standard toeboard.*—(1) A "standard toeboard" shall be from two to six inches nominal in vertical height from its top edge to the level of the floor, platform, runway, or ramp. The toeboard shall be securely fastened in place. The clearance of the toeboard above the floor, platform, runway, or ramp level shall be the lowest that is practical under the existing circumstances. It is expected that in most situations, there shall be a minimum clearance above the level of the floor, platform, runway, or ramp. The toeboard shall be made of substantial material which is either solid or which has openings of not more than one inch in the greatest dimension.

(2) When materials are piled to such a height that the standard toeboard does not provide protection, substantial paneling or screening from the floor to the intermediate rail, or the toprail shall be provided.

(e) *Handrails.*—(1) A handrail shall consist of a lengthwise member mounted directly on a wall or partition by means of brackets attached to the lower side of the handrail so as to offer no obstruction to a smooth surface along the top and both sides of the handrail. The handrail shall be of rounded or other section that will furnish an adequate handhold for anyone grasping to avoid falling. The ends of the handrail should be turned in to the supporting wall or otherwise arranged so as not to constitute a projection hazard.

(2) The height of handrails shall be not more than 34 inches nor less than 30 inches from upper surface of handrail to surface of tread in line with face of riser at the forward edge of the tread.

(3) The size of handrails shall be: (i) When of hardwood, two inches nominal in outside diameter; and (ii) when of metal pipe at least one and one-half inches nominal outside diameter. The length of brackets shall be such as to give a clearance between the handrail and the wall or any projection thereon of at least one and one-half inches. The spacing of brackets shall not exceed eight feet.

(4) The mounting of handrails shall be such that the completed structure is capable of withstanding a load of at least 200 pounds applied in any direction at any point on the rail.

(f) *Clearance of handrails and railings.*—All handrails and railings shall have a clearance of not less than one and one-half inches between the handrail or railing and any other object.

(g) *Floor opening covers.*—Floor opening covers may be of any material that meets the following strength requirements:

(1) Trench or conduit covers and their supports, when located in plant roadways, shall be designed to carry a truck rear-axle load of at least 20,000 pounds.

(2) Manhole covers and their supports, when located in plant roadways, shall be designed to carry a truck rear-axle load of at least 20,000 pounds. Compliance with local standard highway requirements concerning the strength of manhole covers shall be accepted as compliance with this subparagraph.

(3) The construction of floor opening covers may be of any material that meets the surrounding floor strength requirements. Covers projecting not more than 1 inch above the floor level may be used providing all edges are chamfered to an angle with the horizontal of not over 30 degrees. All hinges, handles, bolts, or other parts shall set flush with the floor or cover surface.

(h) *Skylight screens.*— Skylight screens shall be of such construction and mounting that they are capable of withstanding a load of at least 200 pounds applied perpendicularly on the screen. They shall also be of such construction and mounting that under ordinary loads or impacts, they will not deflect downward sufficiently to break the glass below them. The construction shall be of grillwork with openings not more than 4 inches long or of slatwork with openings not more than 2 inches wide with length unrestricted.

(i) *Wall opening barriers.*—Wall opening barriers (rails, picket fences, and half doors) shall be of such construction and mounting that, when in place at the opening, the barrier is capable of withstanding a load of at least 200 pounds applied in any direction (except upward) at any point on the top rail or corresponding member.

(j) *Wall opening grab handles.*—Wall opening grab handles shall be not less than 12 inches in length and shall be so mounted as to give 3 inches clearance from the side framing of the wall opening. The size, material, and anchoring of the grab handle shall be such that the completed structure is capable of withstanding a load of at least 200 pounds applied in any direction at any point on the handle.

(k) *Wall opening screens.*—Wall opening screens shall be of such construction and mounting that they are capable of withstanding a load of at least 200 pounds applied horizontally at any point on the near side of the screen. They may be of solid construction, of grillwork with openings not more than 8 inches long, or of slatwork with openings not more than 4 inches wide with length unrestricted.

§ 1910.24a General application.

(a) The sections under the centerhead "Fixed Industrial Stairs" contain specifications for the safe design and construction of fixed industrial stairs. The term "fixed industrial stairs" includes interior and exterior stairs around machinery, tanks, and other equipment; and stairs leading to or from floors, platforms, or pits.

(b) The sections under the centerhead "Fixed Industrial Stairs" do not apply to stairs used as a means of egress (see Subpart E of this part), to construction operations in private residence, or to articulated stairs, such as may be

installed on floating roof tanks or on dock facilities, the angle of which changes with the rise and fall of the base support.

FIXED INDUSTRIAL STAIRS

§ 1910.24b Definitions.

As used in the sections under the centerhead "Fixed Industrial Stairs", unless the context requires otherwise, fixed industrial stair terms shall have the meaning ascribed in this section.

(a) *Handrail.*—A single bar of wood or pipe supported on brackets from a wall or partition to provide a continuous handhold for persons using a stair.

(b) *Nose, nosing.*—That portion of a tread projecting beyond the face of the riser immediately below.

(c) *Open riser.*—The air space between the treads of stairways without upright members (risers).

(d) *Platform.*—An extended step or landing breaking a continuous run of stairs.

(e) *Railing.*—A vertical barrier erected along exposed sides of stairways and platforms to prevent falls of persons. The top member of railing usually serves as a handrail.

(f) *Rise.*—The vertical distance from the top of a tread to the top of the next higher tread.

(g) *Riser.*—The upright member of a step situated at the back of a lower tread and near the leading edge of the next higher tread.

(h) *Ship stair.*—A series of treads with a slope greater than that of a fixed industrial stair, with handrails attached leading from one level or floor to another, or leading to platforms, pits, boiler rooms, crossovers or around machinery, tanks and other equipment in restricted spaces, in which a fixed industrial stair can not be fitted.

(i) *Stairs, stairway.*—A series of steps leading from one level or floor to another, or leading to platforms, pits, boiler rooms, crossovers, or around machinery, tanks, and other equipment that are used more or less continuously or routinely by employees, or only occasionally by specific individuals. A series of steps and landings having three or more risers constitutes stairs or stairway.

(j) *Tread.*—The horizontal member of a step.

(k) *Tread run.*—The horizontal distance from the leading edge of a tread to the leading edge of an adjacent tread.

§ 1910.24c Where fixed stairs are required.

Fixed stairs shall be provided for access from one structure level to another where operations necessitate regular travel between levels, and for access to operating platforms at any equipment which requires attention routinely during operations. Fixed stairs shall also be provided where access is required to elevations for such purposes as gauging, inspection, regular maintenance, etc., where such work may expose employees to acids, caustics, gases, or other harmful substances, or for which purposes the carrying of tools or equipment by hand is normally required. (It is not the intent of this section to preclude the use of fixed ladders for access to elevated tanks, towers, and similar structures, overhead traveling cranes, etc., where the use of fixed ladders is common practice.)

§ 1910.24d Industrial stair strength.

Fixed industrial stairs shall be designed, constructed, and installed to carry a minimum live load of 100 pounds per square foot. Industrial stair treads shall be designed to carry a minimum concentrated load of 300 pounds on the center line of tread span.

§ 1910.24e Stair width.

Fixed industrial stairs shall have a minimum width of 22 inches.

§ 1910.24f Angle of stairway rise.

(a) Fixed industrial stairs shall be installed at angles to the horizontal of between 30 and 50 degrees with a minimum rise of 6½ inches and a maximum rise of 8½ inches.

(1) Any uniform combination of rise-tread dimensions may be used that will result in a stairway at an angle to the horizontal within the permissible range.

(2) If an indicated elevation cannot be accomplished with fixed industrial stairs under this requirement because of physical restrictions and limited access to elevation, a ship stair may be installed in accordance with standard engineering practices.

§ 1920.24g Industrial stair treads.

Each tread and the top landing of an industrial stair, where risers are used, shall have a nose which extends one-half inch to 1 inch beyond the face of the lower riser. Noses shall have an even leading edge. Riser height and tread width shall be uniform throughout any flight of stairs.

§ 1910.24h Length of industrial stair; landings.

Industrial stairs shall have landings at intervals of not more than 12 feet of vertical rise. The stairway platforms shall be not less than the width of the stairway and have a minimum of 30 inches in length measured in the direction of travel.

§ 1910.24i Railings and handrails.

Standard railings shall be provided on open sides of all exposed stairways and stair platforms. Handrails shall be provided on at least one side of closed stairways. Stair railings and handrails shall be installed in accordance with § 1910.23n.

§ 1910.24j Open risers.

Industrial stairs having treads of less than a nine-inch width may have open risers.

§ 1910.24k Spiral stairway.

(a) A stair having a closed circular form in its plan view with uniform sector shaped treads attached to and radiating about a supporting column. The effective tread is delineated by the nosing radius line, the exterior arc (center-line of railing) and the overlap radius line (nosing radius line of tread above). Effective tread dimensions are taken along a line perpendicular to the center-line of the tread.

(1) A single-way tread shall have an exterior arc chord of at least 10" and minimum effective tread dimension of 6", measured 11" from the exterior arc.

(2) A two-way tread shall have an exterior arc chord of at least 18½" and a minimum effective tread dimension of 10", measured 22" from the exterior arc.

(3) A limited-access tread shall have an exterior arc chord of at least 8½" and minimum effective dimension of 5", measured 9" from the exterior arc. This limited access stair may be used for access to elevated tanks, towers and similar structures, overhead traveling cranes, etc., where the use of fixed ladders is common practice.

(4) The angle of stairway rise is to be between 30° and 50° to the horizontal measured on a line 11" in from the center-line of railing (two-way stair measured 22" in from the center-line of the exterior railing).

(5) The stair is to be designed, constructed and installed to carry a live load of five times the normal live load anticipated.

(6) The anchorage of posts and framing members for railings of all types shall be designed using standard engineering practices for stresses, safety factors, etc. The completed railing shall be designed and constructed to withstand a load of 25 pounds per linear foot applied in any direction at the top of the railing. The intermediate rail shall be capable of withstanding a horizontal load of 20 pounds per linear foot. The end of terminal posts shall be capable of withstanding a load of 200 pounds applied in any direction at the top of the post. The above loads are not additive. In lieu of the intermediate rail, vertical balusters may be used if the distance between balusters does not exceed 9". On a two-way stair a single-line handrail, supported from the center post, will be provided with a minimum clearance between railings of 42".

(7) Vertical clearance shall be 6'–6".

PORTABLE WOODEN LADDERS

§ 1910.25 Application of requirements.

The sections under the centerhead "Portable Wooden Ladders" are intended to prescribe rules and establish minimum requirements for the construction, care, and use of the common types of portable wood ladders, in order to insure safety under normal conditions of usage. Special wooden ladders such as fruitpicker's ladders, combination step and extension ladders, shelf ladders, and library ladders and other similar types of ladders are not covered by these sections.

§ 1910.25a Materials.

(a) *Requirements applicable to all wood parts.*—(1) All wood parts shall be of the species specified in Table D–5, seasoned to a moisture content of not more than 15 percent; smoothly machined and

dressed on all sides; free from sharp edges and splinters; sound and free by accepted visual inspection from shake, wane, compression failures, decay, or other irregularities except as hereinafter provided. Low density wood shall not be used.

(2) Black streaks in western hemlock shall not be considered an irregularity, except that chambers associated with black streaks, when present in the part, shall be limited as specified for pitch and bark pockets.

(b) *Permissible irregularities in side rails and back rails.*—(1) The general slope of grain in side rails of minimum dimension shall not be steeper than 1 in 12, except that for ladders under 10 feet in length and having flat steps for treads, the general slope of grain shall not be steeper than 1 in 10. The slope of grain in areas of local grain deviation shall not be steeper than 1 in 12 or 1 in 10 as specified above when occurring on the edges or in the outer one-fourth of the width of the wide face. Local areas of grain deviation within the center half of the width of the wide face may contain grain slope as steep as 1 in 8. Local deviations of grain associated with otherwise permissible irregularities are permitted.

(2) Knots shall not appear in narrow faces of side rails. Knots, if tight and sound and less than one-half inch in diameter, are permitted on the wide face provided they are at least one-half inch back from either edge and not more frequent than 1 to any 3 feet of ladder length.

(3) Pitch and bark pockets are permitted provided they are not more than one-eighth inch in width, or more than 2 inches in length, or more than one-half inch in depth, and then only if they are not more frequent than 1 to any 3 feet of ladder length.

(4) Checks are permitted on side rails provided they are not more than 6 inches in length or more than one-half inch in depth.

(5) Occurrences of compression wood in relatively small amounts and positively identified by competent and conscientious visual inspection of side rails are permitted provided no single streak shall exceed one-half inch in width nor shall the aggregate of streaks exceed one-fourth of the face of the side rail. Borderline forms of compression wood not positively identified by competent and conscientious visual inspection are permitted. Ladder parts containing bow or crook which would interfere with the operation of the ladder shall not be used.

(c) *Permissible irregularities in flat steps, rungs, and cleats.*—(1) The general slope of grain in flat steps of minimum dimension shall not be steeper than 1 in 12, except that for ladders under 10 feet in length the slope of grain shall not be steeper than 1 in 10. The slope of grain in areas of local deviation shall not be steeper than 1 in 12 or 1 in 10 as specified above. For all ladders, cross grain not steeper than 1 in 10 are permitted in lieu of 1 in 12, provided the size is increased to afford at least 15 percent greater calculated strength than for ladders built to minimum dimensions. Local deviations of grain associated with otherwise permissible irregularities are permitted.

(2) The general slope of grain and that in areas of local deviations of grain shall not be steeper than 1 in 15 in rungs and cleats. For all ladders cross grain not steeper than 1 in 12 are permitted in lieu of 1 in 15, provided the size is increased to afford at least 15 percent greater calculated strength for ladders built to minimum dimensions. Local deviations of grain associated with otherwise permissible irregularities are permitted.

(3) Knots over one-eighth inch in diameter shall not appear in rungs. Knots shall not appear in the narrow faces of flat steps and cleats. Knots appearing in the wide faces of flat steps and cleats shall not exceed a diameter of one-fourth inch.

(d) *Classification of species of wood.*—Table D–5 gives a list of native woods, divided into four groups on the basis of mechanical properties considered from the standpoint of use for ladder construction.

(1) All minimum dimensions and specifications set forth hereinafter for side rails and flat steps are based on the species of wood listed in Group 3 in Table D–5 except where otherwise provided. The species of all other groups may be substituted for those of Group 3 when used in sizes that provide at least equivalent strength. (See Table D–5 for suggested methods of size adjustment.)

(2) All minimum dimensions and specifications set forth hereinafter for rungs and cleats are based on the species of wood listed in Group 1 in Table D–5. Cleats may be made of species of any other group: *Provided,* That the cross-sectional dimensions specified for Group 1 species are increased by the factors shown in this subdivision (based on the percentages of Table D–5) for the species group of which the cleats are to be made.

Species group	Factor for Increase in: Each dimension	Width only (thickness unchanged)
1	1.00	1.00
2	1.03	1.05
3	1.11	1.19
4	1.17	1.26

(e) *Metal parts.*—All metal parts shall be made of aluminum, steel, wrought iron, malleable iron, or other material, adequate in strength for the purpose intended.

§ 1910.25b Construction requirements.

(a) *Basis of requirements.*—(1) Dimensions specified hereinafter for wood ladders are the minimum dressed cross-sectional dimensions for the types of ladders herein designated, based on the species of woods specified in § 1910.25a(d) of this subpart, at a moisture content of 15 percent. The dimensions for side rails are based on a mortise or gain as specified for the various types of ladders for step or rung attachments. Where the strength of the side rails or back legs is reduced by a greater mortise or gain than shown, or where it is desired to use a cross section for any wood part either dimension of which is less than that specified, the required dimensions may be found as indicated in subparagraph (2) of this paragraph.

(2) For the side rails of single extension and sectional ladders, the proposed section shall develop an actual stress per square inch not greater than 2,150 pounds for Group 1 woods, 2,000 pounds for Group 2 woods, 1,600 pounds for Group 3 woods, or 1,375 pounds for Group 4 woods when computed by the following formula applying to rectangular sections, with a maximum tolerance of 5 percent over these stresses:

$$S=\frac{3LD\,(P+W/16)}{2B(D^3-d)}\quad\frac{1.5LD\,(25+W/16)}{B(D^3-0.67)}$$

P=25 pounds, which is the normal component on each rail of a load of 200 pounds at the center of the ladder, equally distributed between the rails, when the foot of the ladder is moved out of the perpendicular by one-quarter of its length.
S=Stress in extreme fiber in pounds per square inch.
W=Weight of ladder in pounds.
L=Maximum working length of ladder in inches.
B=Net thickness of each side rail in inches.
D=Depth of side rail in inches.
d=Diameter of hole bored for rung (d^3 shall be taken as not less than 0.67).

(3) Adjustment of sizes for wood parts of stepladders and other ladder types covered by this section may be made as follows:

(i) The dimensions specified in later sections for parts having rectangular cross sections generally represent only one of a number of possible combinations of thickness and width which could satisfy the requirements for strength and stiffness. Depending upon the material sizes available, manufacturing practices, and like factors, parts produced by a particular manufacturer may or may not agree exactly with the sizes given later. The following provisions of this subparagraph provide means for determining equality of load-carrying capacity of parts of different sizes or of determining sizes needed to provide equality.

(ii) Any changes in dimensions shall result in a change in the width-thickness ratio for side rails of back legs not greater than 25 percent from the ratio for a corresponding ladder as now covered in this section.

(iii) Where both dimensions are different from those specified, the load-carrying capacity in bending of a part will be equal to or greater than that of a part of specified dimensions if the ratio P_2/P_1 is not less than 1, where

$$\frac{P_2}{P_1}=\frac{B_2D_2^2}{B_1D_1^2}$$

and

B=Dimensions of the part at right angles to the direction of load (width of a step, thickness of a side rail or back leg).
D=Dimensions of the part parallel to the direction of load (thickness of a step, width of a side rail or back leg).
B_1D_1=Dimensions as specified.
B_2D_2=Dimensions of part being considered.

(iv) The dimensions to be used in the computations are net dimensions. For example, in the case of a stepladder side rail, the dimension B is to be taken as the gross thickness of the rail minus the depth of the gain for the steps. Where there is a rung hole at the center of depth of a rail, a somewhat more accurate comparison may be made by the use of the formula

$$\frac{P_2}{P_1} = \frac{B_2 D_1 (D_2^3 - d^3)}{B_1 D_2 (D_1^3 - d^3)}$$

where the symbols have the same meanings as previously stated and d is the diameter of the hole for the rung tenon. In most instances the difference in results calculated by this and by the earlier formula will be slight.

(b) *Portable stepladders.*—Stepladders longer than 20 feet shall not be used. Stepladders as hereinafter specified shall be of three types:

Type I—Industrial stepladder, 3 to 20 feet for heavy duty, such as utilities, contractors, and industrial use.

Type II—Commercial stepladder, 3 to 12 feet for medium duty, such as painters, offices, and light industrial use.

Type III—Household stepladder, 3 to 6 feet for light duty, such as light household uses.

(1) *General requirements.*—(i) Slope is the inclination of side rails or back legs with respect to the vertical and is expressed as a deviaton from the vertical per unit length of the member. Stepladders shall be so constructed, that when in the open position, the slope of the front section shall not be less than 3½ inches and the slope of the back section not less than 2 inches, for each 12-inch length of side rail.

(ii) A uniform step spacing shall be employed which shall be not more than 12 inches. Steps shall be parallel and level when the ladder is in position for use.

(iii) The minimum width between side rails at the top step, inside to inside, shall be not less than 11½ inches. From top to bottom, the side rails shall spread at least 1 inch for each foot of length of stepladder.

(iv) When minimum thickness of side rails is used, steps shall be closely fitted into the grooves in the side rails one-eighth inch in depth with a tolerance of one thirty-second inch, and shall be firmly secured as hereinafter described; or they shall be closely fitted into metal brackets of an equivalent strength, which in turn shall be firmly secured to the side rails. The depth of groove herein provided may be increased in proportion to the thickness of side rails as provided in subparagraphs (2)(i), (3)(i), and (4)(i) of this paragraph.

(v) All stepladders shall have a top with wood or metal brackets or fittings tightly secured to the top, side rails, and back legs, to allow free swinging of the back section without excessive play or wear at the joints.

(vi) A metal spreader or locking device of sufficient size and strength to securely hold the front and back sections in open positions shall be a component of each stepladder. The spreader shall have all sharp points covered or removed to protect the user. For type III ladder, the pail shelf and spreader may be combined in one unit (the so-called shelf-lock ladder).

(vii) When measured along the front edge of the side rails, all stepladders shall measure within 3 inches of the specified length.

(viii) Where bucket shelves are provided, they shall be constructed to support a load of 25 pounds and shall be so fastened that they can be folded up when the ladder is closed.

(ix) All metal parts and fittings shall be securely attached by means of rivets, bolts, screws, or equivalent fasteners.

(2) *Type I industrial stepladder.* (i) (A) The minimum dimensions of the parts of the Type I stepladder shall be as shown in Table D–2 when made of Group 2 or Group 3 woods.

(B) The minimum thickness of side rails provides for the cutting of a groove of one-eighth inch in depth with the tolerance indicated in paragraph (b)(1)(iv) of this section.

(ii) Steps shall be secured with at least two 6–d nails at each end, or the equivalent thereof. Each step shall be reinforced by a steel rod not less than 0.160 inch in diameter with standard commercial tolerances, which shall pass through metal washers of sufficient thickness and diameter on each end to prevent pressing into the side rails, and a truss block which shall be fitted between the rod and the center of each step or by a metal angle brace on each end firmly secured to the steps and side rails, or by construction of equivalent strength and safety. Where the rod reinforcement construction is used, the bottom step shall also be provided with a metal angle brace on each end which shall be securely attached to the bottom step and side rails. In addition, all steps 3⅝ inches wide and 27 inches or more in overall length and all steps 4¼ inches wide and 32 inches or more in overall length shall be provided with a metal angle brace at each end securely attached to the step and side rail.

(iii) The back legs shall be braced by one of the following methods:

(A) The back legs shall be braced with 1⅛ inch diameter rungs of Group I woods (see Table D–5), or material of equivalent strength, having ⅞ inch diameter tenons or oval wood rungs, or rectangular wood rungs of equivalent strength, spaced not more than 12 inches apart. The back legs shall be bored with holes either extending through the legs or to within three-sixteenths inch of the outside face of the legs, the size of the hole to be such as to insure a tight fit for the rung. The shoulder of the rung shall be forced firmly against the leg, and the tenon secured in place with a nail, or the equivalent thereof, to prevent turning of the rungs. The back legs shall be braced by a metal angle brace on each side, securely fastened to the rung and the back legs, one rung to be braced for each 4 feet of length or fraction thereof, on ladders 4 feet or more in length, with braces required only on the bottom rung for ladders that are 4 feet or shorter. Where rungs are more than 28 inches in length between the back legs they shall be provided with center bearing consisting of a wood bar not less than ¾ by 2 inches in cross-section securely nailed to each rung passing through it and long enough to include each rung longer than 28 inches.

(B) The back leg shall be braced with horizontal wood bars of Group 1, 2, or 3 woods in Table D–5 and not less than ¾ by 2½ inches in cross-section spaced not more than 12 inches apart. The ends of the bars shall fit into metal sockets of not less than 20-gauge (Manufacturers Standard) steel, or other material of equivalent strength, or into mortises of not less than one-eighth inch (tolerance of ± one-thirty-second inch) in depth in the back legs. A steel rod not less than 0.160 inch in diameter with standard commercial tolerance shall pass through the back legs, the bar, and at each end through metal washers of sufficient diameter and thickness to prevent pressing into the back legs. The back legs shall also be braced by a metal angle brace on each side, securely fastened to the bar and to the legs, one bar to be so braced for at least each 4 feet of length or fraction thereof, with braces required only on bottom bar for ladders that are 4 feet or shorter. Metal sockets when used shall be attached to the back legs by rivets or by means of a rod running through the socket or equivalent thereof.

TABLE D–2

DIMENSIONS FOR TYPE I STEP LADDER

	Length, 12 feet and less		Length, 14 and 16 feet		Length, 18 and 20 feet	
	Thickness (inch)	*Depth (inches)*	*Thickness (inch)*	*Depth (inches)*	*Thickness (inch)*	*Depth (inches)*
Side rails	¾	3¼	¾	3½	1 1/16	3½
Back legs	¾	2¼	¾	2⅝	1 1/16	2¼
Steps	¾	3⅝	¾	4¼	¾	4¼
Tops	¾	5½	¾	5½	¾	5½

TABLE D–3

DIMENSIONS FOR TYPE II STEP LADDER

	Length, 3 to 8 feet		Length, 10 feet		Length, 12 feet	
	Thickness (inch)	*Depth (inches)*	*Thickness (inch)*	*Depth (inches)*	*Thickness (inch)*	*Depth (inches)*
Side rails	¾	2⅝	¾	2⅝	¾	3
Back legs	¾	1⅝	¾	1¾	¾	2
Steps	¾	3½	¾	3½	¾	3⅝
Tops	¾	5	¾	5	¾	5

(iv) The back legs shall be reinforced by a rivet through the depth of the leg above the hinge point, by metal plates or collars at the hinge point, or by other means suitable for preventing splitting of the back leg from the hinge pin to the top.

(3) *Type II commercial stepladders.*—(i) (A) The minimum dimensions of the parts of the Type II stepladder shall be as given in Table D–3 when made of Group 2 or Group 3 woods.

(B) The minimum thickness of side rails provides for the cutting of a groove of one-eighth inch in depth with the tolerance indicated in paragraph (b) (1) (iv) of this section, and shall be increased when grooves of greater depth are used.

(ii) Steps shall be secured with at least two 6–d rails at each end, or the equivalent thereof. Each step shall be reinforced by a steel rod not less than 0.160 inch in diameter with standard commercial tolerances which shall pass through metal washers of sufficient thickness and diameter on each end to prevent pressing into the side rails, and a truss block shall be fitted between the truss rod and center of each step; or by a metal angle brace on each end firmly secured to the steps and side rails; or by construction of equivalent strength and safety. Where the rod reinforcement construction is used, the bottom step shall be provided further with a metal angle brace on each end which shall be securely attached to the bottom step. In addition all steps 27 inches or more in overall length shall be provided with a metal angle brace at each end securely attached to the step and side rails.

(iii) The back legs shall be braced by one of the three following methods:

(A) (*1*) With ⅞-inch diameter wood dowels of Group 1 woods (see Table D–5) or material of equivalent strength having not less than ⅝-inch tenons firmly secured in the back legs and spaced not more than 12 inches apart. The back legs shall be bored with holes either extending through the legs or to within three-sixteenths inch of the outside face of the legs, the size of the holes to be such as to insure a tight fit for the dowel. The shoulder of the dowel shall be forced firmly against the leg and the tenon secured in place with a nail, or the equivalent thereof, to prevent turning of the dowel.

(2) A bar connecting two or more of the dowels shall be provided on all ladders of 6 feet or more. The cross-sectional dimensions of the bar shall be the same as the cross-sectional dimensions of the back legs, and the dowels shall pass through holes at the centerline of the bar. The bar shall be attached at the center of the length of the lower two dowels on a 6-foot ladder and shall extend upward one dowel for each 2 feet of added length.

(B) With wood dowels as set forth in this subparagraph (3) (iii) (A) of this paragraph, plus an inverted V bracing of ¾- by 1½-inch material through which the dowels extend two-thirds of the way up the back.

(C) With horizontal bracing of Group 1, 2, 3, or 4 woods (see Table D–5) not less than ¾ by 2 inches in cross-section, the ends of which shall fit into metal sockets of not less than 20-gauge (Manufacturing Standard), steel, or other material of equivalent strength or into mortises not less than one-eighth inch in depth in back legs. The bars shall be reinforced by steel rods not less than 0.160 inch in diameter with standrad commercial tolerances which shall pass through the back legs, the bar, and, at each end, through metal washers of sufficient diameter and thickness to prevent pressing into the back legs. The spacing of such braces shall not exceed 3 feet, and there shall be one brace on 3- and 4-foot ladders, two braces on 5- and 6-foot ladders, three braces on 7- and 8-foot ladders, and four braces on 10- and 12-foot ladders. The bottom bar shall not be more than 18 inches from the bottom of the ladder, and, where only one bar is used, it shall be braced by a metal angle brace on each end securely attached to the bar and the back leg.

(4) *Type III household stepladder.*—(i) The minimum dimensions of the parts of the Type III stepladder shall be as follows when made of Group 2 or Group 3 woods:

	Length, 3 to 6 feet	
	Thickness (inch)	Depth (inches)
Side rails	¾	2½
Back legs	¾	1⅝
Steps	¾	3
Top	¾	5

The minimum thicknesses of side rails provide for the cutting of a groove one-eighth inch in depth with the tolerance indicated in paragraph (b) (1) (iv) of this section, and shall be increased when grooves of greater depth are used.

(ii) Steps shall be secured with at least one 6-d nail at each end, or the equivalent thereof. Each step shall be reinforced by a steel rod not less than 0.160 inch in diameter with standard commercial tolerance which shall pass through metal washers of sufficient thickness and diameter to prevent pressing into the side rails, or by a metal brace at each end firmly secured to steps and side rails or by construction of equivalent strength and safety. Where the rod reinforcement construction is used, the bottom step shall be provided further with a metal angle brace on each end which shall be securely attached to the bottom step and side rail.

(iii) Back legs shall be braced by one of the two following methods or by a construction of equivalent strength and safety:

(A) By diagonal slats or groups 1, 2, 3, or 4 wood (see Table D–5) not less than 5/16 by 1¼ inches securely fastened to the back legs by nails, screws, or the equivalent thereof.

(B) With horizontal bracing of Groups 1, 2, 3, or 4 wood (see Table D–5) not less than ⅝ by 1⅝ inches in cross section, the ends of which shall fit into metal sockets of not less than 20-gauge (Manufacturing Standard) steel or other material of equivalent strength or into mortises not less than one-eighth inch in depth in back leg. The bars shall be reinforced by steel rods not less than 0.160 inch in diameter with standard commercial tolerances which shall pass through the back leg, the bar, and at each end through metal washers of sufficient diameter and thickness to prevent pressing into each leg. The spacing of such bars shall not exceed 3 feet, and there shall be one brace on 3- and 4-foot ladders, two braces on 5- and 6-foot ladders. The bottom bar shall be not more than 18 inches from the bottom of the ladder.

(C) *Portable rung ladders.*—Portable rung ladders as herein specified shall be of four types, as follows: Single ladder; two-section extension ladder; sectional ladder; trestle and extension trestle ladder.

(*i*) *General requirements.*—(*i*) The base or lower portion of a ladder may have either parallel sides or flared sides in accordance with commercial practices.

(*ii*) Rungs shall be parallel, level, and uniformly spaced. The spacing shall be not more than 12 inches, except as hereinafter specified.

(*iii*) All holes for wood rungs shall either extend through the side rails or be bored so as to give at least a thirteen-sixteenths-inch length of bearing of the rung tenon. In through-bored construction, the rungs shall extend at least flush with the outside rail surface. All holes shall be located on the center line of the wide face of the side rails and shall be of such size as to insure a tight fit for the rung. The shoulder of the rung shall be forced firmly against the side rails and the tenon secured in place with a nail or the equivalent thereof, for the sole purpose of preventing the turning of the rung and maintaining the rung position in the side rail.

(*iv*) Round rungs shall be of Group 1 woods (see Table D–5), shall be not less than 1⅛ inches in diameter for lengths up to 36 inches between side rails and 1¼ inches in diameter for lengths over 36 up to and including 72 inches, and shall have not less than seven-eighths-inch-diameter tenons, or rungs of equivalent strength and bearing shall be provided. When rungs are 28 inches or more in length between side rails, they shall, in addition, be provided with center bearing.

(*v*) Oval rungs or rungs of any other cross section may be used provided they are secured by a nail at each end or the equivalent thereof and have at least the same strength and bearing as round rungs of the same length.

(*vi*) All metal parts and fittings shall be securely attached by means of rivets, bolts, screws, or equivalent fasteners.

(*vii*) The construction and assembly of the movable parts shall be such that they shall operate freely and securely without binding or unnecessary play.

(*viii*) When measured along the side rails, no rung ladder or section thereof shall be more than 4 inches shorter than the specified length.

(ix) Nonslip bases when used shall be securely bolted, riveted, or attached by equivalent construction to the side rails.

(x) Hooks when used shall be securely bolted or riveted to the side rails or equivalent construction and shall be of such dimensions as to withstand the loads imposed upon them.

(2) *Single ladder.* (i) Single ladders longer than 30 feet shall not be used.

(ii) The minimum dimensions of the side rails of the single ladder shall be as follows when made of Group 2 or Group 3 woods.

Length of ladder (feet)	Thickness (inches)	Depth (inches)
Up to and including 16	1⅛	2½
Over 16 up to and including 22	1¼	2¾
Over 22 up to and including 30	1¼	3

(iii) Smaller side rails will be acceptable in all ladders of this type when reinforced by a steel wire, rod, or strap running the length of the side rails and adequately secured thereto. Where such reinforcement is used, the reinforced rails shall be equivalent in strength to the side rails specified in this subparagraph (2)(ii) of this paragraph.

(iv) The width between the side rails at the base, inside to inside, shall be at least 11½ inches for all ladders up to and including 10 feet. Such minimum widths shall be increased at least one-fourth inch for each additional 2 feet of length.

(3) *Two-section ladder.*—(i) Two-section extension ladders longer than 60 feet shall not be supplied. All ladders of this type shall consist of two sections, one to fit within the side rails of the other, and arranged in such a manner that the upper section can be raised and lowered.

(ii) The minimum dimensions of the side rails of the two-section extension ladder shall be not less than specified in Table D–4 of this section.

(iii) The minimum dimensions of side rails set forth in Table D–4 are based on the maximum working length, which is the size of ladder less the minimum overlap, which shall be as follows:

Size of ladder (feet):	*Overlap (feet)*
Up to and including 36	3
Over 36 up to and including 48	4
Over 48 up to and including 60	5

(iv) Smaller side rails will be acceptable in all ladders of this type when reinforced by a steel wire, rod or strap running the length of the side rails and adequately secured thereto. Where such reinforcement is used, the reinforced rails shall be equivalent in strength to the side rails specified in Table D–4.

(v) The minimum distance between side rails of the bottom section, inside to inside, shall be 14½ inches on ladders up to and including 28 feet; 16 inches on all ladders over 28 feet up to and including 40 feet; 18 inches on all ladders over 40 feet.

(vi) All locks and guide irons shall be of metal and shall be of such construction and strength as to develop the full strength of the side rails. All locks shall be positive in their action. The guide irons shall be securely attached and so placed as to prevent the upper section from tipping or falling out while it is being raised, lowered, or is in use.

(vii)(A) Ladders of this type may be equipped with a rope and pulley. When a ladder is so equipped, the rope and pulley shall be securely attached to the ladder in a manner not weakening either the rungs or the side rails. The pulley shall be not less than 1¼ inches in diameter.

(B) The rope used with the pulley shall be not less than five-sixteenths inch in diameter having a minimum breaking strength of 560 pounds, and shall be of sufficient length for the purpose intended.

(4) *Sectional ladder.* (i) Assembled combinations of sectional ladders longer than lengths specified in § 1910.25b(c)(3) shall not be used.

(ii) The minimum dimensions of side rails shall be as follows for Group 2 or Group 3 woods:

Assembled length of ladder (feet)	Thickness (inches)	Depth (inches)
Up to and including 21	1⅛	2¾
Over 21 up to and including 31	1⅛	3⅛

(iii) Ladders of this type shall have either straight sides slightly converging toward the top of each section, or shall have flaring sides at the bottom of the first (or bottom) section, with the top section having converging side rails to a width that shall be not less than 4 inches. Except for the top section, the minimum width between side rails shall be 11 inches.

(A) Adjacent sections shall be joined by means of a groove in the bottom end of each rail of the upper of the two sections setting firmly over extensions outside the side rails of the topmost rung of the next lower section and, at the same time, a groove in the top end of each rail of the lower of the two sections setting firmly over the bottom rung, inside the side rails, of the section next above.

TABLE D–4—DIMENSIONS OF SIDE RAILS FOR TWO-SECTION LADDER

Size of ladder, overall length (feet)	Rail	
	Thickness (inches)	Depth (inches)
For group 2 woods		
16	1⅛ ×	2
20	1⅛ ×	2¼
24	1⅛ ×	2½
28	1⅛ ×	2¾
32	1⅛ ×	2¾
36	1⅝ ×	2¾
40	1⅝ ×	2¾
44	1⅝ ×	3
For group 3 woods		
16	1⅛ ×	2
20	1⅛ ×	2¼
24	1⅛ ×	2½
28	1⅛ ×	2¾
32	1⅝ ×	2¾
36	1⅝ ×	3
40	1⅜ ×	3
44	1⅜ ×	3¼
48–52	1⅜ ×	3¾
56–60	1⅝ ×	3¾

(B) The distance between the two rungs (topmost rung of one section, bottom rung of the section next above) mentioned in subparagraph (4)(iii)(A) of this paragraph shall not be less than 1 foot.

(C) The fit between rail grooves and rungs mentioned in subparagraph (4)(iii)(A) of this paragraph shall be such as to provided a good fit without binding or unnecessary play.

(D) The grooved ends of the section shall be reinforced with a metal plate of not less 18-gauge (Manufacturing Standard) material properly secured thereto, and a rivet adjacent to the groove, extending through the depth of the rail, or the equivalent thereof.

(5) *Trestle and extension trestle ladder.*—(i) Trestle ladders, or extension sections or base sections of extension trestle ladders longer than 20 feet shall be used.

(ii) The minimum dimensions of the side rails of the trestle ladder, or the base sections of the extension trestle ladder, shall be as follows for Group 2 or Group 3 woods:

Size of ladder (feet)	Thickness (inches)	Depth (inches)
Up to and including 16	1⅝	2¾
Over 16 up to and including 20	1⅝	3

(iii) The minimum dimensions of the side rails of the extension section of the extension trestle ladder, which shall have parallel sides, shall be as follows for Group 2 or Group 3 woods:

Size of ladder (feet)	Thickness (inches)	Depth (inches)
Up to and including 12	1⅝	2¼
Over 12 up to and including 16	1⅝	2½
Over 16 up to and including 20	1⅝	2¾

(iv) Trestle ladders and base sections of extension trestle ladders shall be so spread that when in an open position the spread of the trestle at the bottom, inside to inside, shall be at least 5½ inches per foot of the length of the ladder.

(v) The width between the side rails at the base of the trestle ladder and base sections of the extension trestle ladder shall be at least 21 inches for all ladders and sections up to and including 6 feet. Longer lengths shall be increased at least 1 inch for each additional foot of length. The width between the side rails of the extension sections of the trestle ladder shall be not less than 12 inches.

(vi) The tops of the side rails of the trestle ladder and of the base section of the extension trestle ladder shall be beveled, or equivalent construction, and shall be provided further with a metal hinge to prevent spreading.

(vii) A metal spreader or locking device to hold the front and back sec-

tions in an open position, and to hold the extension section securely in the elevated position shall be a component of all extension trestle ladders and all trestle ladders over 12 feet in length.

(viii) Rungs shall be parallel and level. On the trestle ladder, or on the base sections of the extension trestle ladder, rungs shall be spaced not less than 8 inches or more than 18 inches apart; on the extension section of the extension trestle ladder, rungs shall be spaced not less than 6 inches or more than 12 inches apart.

(d) *Special-purpose ladders.*—All special-purpose ladders shall comply with the appropriate requirements of paragraphs (a), (b), and (c) of this section, except as hereinafter modified in this paragraph.

(1) *Platform stepladder.*—A platform stepladder is a modification of a portable stepladder with a working platform provided near the top.

(i) Platform stepladders shall be made in accordance with the requirements for type I stepladders or in accordance with the requirements for type II stepladders.

(ii) The slope of the back section shall be such that a vertical from the back edge of the platform will strike the floor at a distance measured toward the front section of not less than 3 inches from the base of the back section.

(iii) The minimum width between side rails at the platform shall be not less than 15 inches.

(iv) The back legs and side rails shall extend at least 24 inches above the platform and shall be connected with a top member to form a three-sided rail, or equivalent construction shall be provided.

(v) Platforms shall be so constructed as to be capable of supporting a load of 200 pounds placed at any point on the platform.

(vi) A separate spreader may be omitted from platform ladders in which the height to the platform is 6 feet or less. If the spreader is omitted, the platform shall be so designed as to function as a spreader or locking device to hold the front and back sections securely in an open position, with the connection between side rails and back legs being through the metal parts of the platform. The wood parts of a combined wood and metal platform functioning as a spreader shall not be depended upon to contribute to the spreading or locking action.

(2) *Painter's stepladder.*—(i) Painter's stepladders longer than 12 feet shall not be used.

(ii) Painter's stepladders shall be made in accordance with the requirements of type II stepladders except for the following:

(A) The top may be omitted.

(B) A rope spreader may be substituted for the metal spreader required in paragraph (b) (1) (vi) of this section. The rope shall not be less than No. 6 sash cord or its equivalent.

(3) *Mason's ladder.*—A mason's ladder is a special type of single ladder intended for use in heavy construction work.

(i) Mason's ladders longer than 40 feet shall not be used.

(ii) The minimum dimensions of the side rails when made of Group 2 or Group 3 woods and rungs (Group 1 woods) of the mason's ladder shall be as follows:

Length of ladder (feet)	Side rails		Diameter	
	Thickness (inches)	Depth (inches)	Rung (inches)	Tenon (inches)
Up to and including 22	1⅝	3⅝	1⅜	1
Over 22 up to and including 40	1⅝	4½	1⅜	1

(iii) The width between the side rails at the bottom rung, inside to inside, shall be not less than 12 inches for all ladders up to and including 10 feet. Such minimum widths shall be increased by at least one-fourth inch for each additional 2 feet of length.

(iv) Rungs shall be parallel and level and shall be spaced not less than 8 inches or more than 12 inches apart.

(A) *Trolley and side-rolling ladders.*—(1) *Length.*—Trolley ladders and side-rolling ladders longer than 20 feet should not be used.

(2) *Dimensions.*—The dimensions of the side rails shall not be less than the following for Group 2 or Group 3 woods:

Length of side rail (feet)	Thickness (inch)	Depth (inches)
Up to and including 10	25/32	3
Over 10 up to and including 20	25/32	3¼

The minimum thickness of side rails provide for the cutting of a groove not over one-eight inch in depth and shall be increased when grooves of greater depth are used. Flat steps shall have the following minimum dimensions for Group 2 or Group 3 woods:

Length of step (inches)	Thickness (inch)	Width (inches)
Up to and including 16	25/32	3
Over 16 up to and including 20	25/32	3¼
Over 20 up to and including 24	25/32	3½
Over 24 up to and including 28	25/32	4

(3) *Width.*—The width between the side rails, inside to inside, shall be at least 12 inches.

(4) *Step attachment.*—Flat steps shall be inset in the side rails one-eighth inch and secured with at least two 6-d nails at each end or the equivalent thereof. They shall be reinforced with angle braces or a 3/16-inch steel rod.

(5) *Locking device.*—Locking devices should be provided on all trolley ladders.

(6) *Tracks.*—(i) Tracks shall be wood, or metal (excluding cast iron), or a combination of these materials.

(ii) Tracks for the top end of ladders shall be fastened securely and shall be so constructed that the wheels will not jump the track. Tracks shall be so designed as to provide for all probable loads to which they will be subjected.

(iii) The supports shall be securely fastened by lag screws, machine, hook, or toggle bolts, or their equivalent.

(iv) Tracks for side-rolling ladders shall be supported by metal or wood brackets securely screwed or bolted to shelving or other permanent structure at not over 3 feet.

(7) *Wheel carriages.*—(i) Wheel carriages shall be so designed as to provide for all loads to which they will be subjected. Two-point suspension should be used.

(ii) The wheel carriage for the top end of the ladder shall be securely fastened to the top of the ladder with metal brackets bolted either to the side rails or to the top step. When bolted to the top step, this step shall be secured to the side rail with metal braces in addition to those otherwise provided. The wheel carriage shall be so designed that a loose or broken wheel will not allow the ladder to drop or become detached from the track.

(iii) The wheel carriage for the bottom end of the ladder shall be securely fastened to the bottom of the ladder.

(iv) The wheels at the upper end of the ladder shall have minimum wheel base of 8 inches.

(v) When wheels are used at the bottom of the ladder, there shall be at least one wheel supporting each side rail.

(vi) Running gear for bottoms of both trolley and side-rolling ladders shall be so designed and constructed as to provide for any load to which they will be subjected.

§ 1910.25c Care and use of ladders.

(a) *Care.*—To insure safety and serviceability the following precautions on the care of ladders shall be complied with:

(1) Ladders shall be maintained in good condition at all times, the joint between the steps and side rails shall be tight, all hardware and fittings securely attached, and the movable parts shall operate freely without binding or undue play.

(2) Metal bearings of locks, wheels, pulleys, etc., shall be frequently lubricated.

(3) Frayed or badly worn rope shall be replaced.

(4) Safety feet and other auxiliary equipment shall be kept in good condition to insure proper performance.

(5) Ladders shall be stored in such a manner as to provide ease of access or inspection, and to prevent danger of accident when withdrawing a ladder for use.

(6) Wood ladders, when not in use, shall be stored at a location where they will not be exposed to the elements, but where there is good ventilation. They shall not be stored near radiators, stoves, steam pipes, or other places subjected to excessive heat or dampness.

(7) Ladders stored in a horizontal position shall be supported at a sufficient number of points to avoid sagging and permanent set.

(8) Ladders carried on vehicles shall be adequately supported to avoid sagging and securely fastened in position to minimize chafing and the effects of road shocks.

(9) Ladders shall be kept coated with a suitable protective material.

(10) Ladders shall be inspected frequently and those which have developed defects shall be withdrawn from service for repair or destruction and tagged or marked as "Dangerous, Do Not Use."

(11) Rungs shall be kept free of grease and oil.

(b) *Use.*—The following safety precautions shall be observed in connection with the use of ladders:

(1) Portable rung and cleat ladders shall, where possible, be used at such a pitch that the horizontal distance from the top support to the foot of the ladder is one-quarter of the working length of the ladder (the length along the ladder between the foot and the top support). The ladder shall be so placed as to prevent slipping or it shall be lashed, or held in position. Ladders shall not be used in a horizontal position as platforms, runways, or scaffolds;

(2) Ladders for which dimensions are specified shall not be used by more than one man at a time, nor with ladder jacks and scaffold planks where the use by more than one man is anticipated, unless the ladders have larger dimensions of the parts specifically designed for use by the number of men involved.

(3) Portable ladders shall be so placed that the side rails have secure footing. The top rest for portable rung and cleat ladders shall be reasonably rigid and shall have ample strength to support the applied load.

(4) Ladders shall not be placed in front of doors opening toward the ladder unless the door is blocked, open, locked, or guarded.

(5) Ladders shall not be placed on boxes, barrels, or other unstable bases to obtain additional height.

(6) To support the top of the ladder at a window opening, a board shall be attached across the back of the ladder, extending across the window and provided firm support against the building walls or window frames.

(7) When ascending or descending, the employee shall face the ladder.

(8) Ladders with broken or missing steps, rungs or cleats, broken side rails, or other faulty equipment shall not be used; improvised repairs shall not be made.

(9) Short ladders shall not be spliced together to provide long sections.

(10) Ladders made by fastening cleats across a single rail shall not be used.

(11) Ladders shall not be used as guys, braces, or skids, or for other than their intended purposes;

(12) Tops of the ordinary types of stepladders shall be not be used as steps;

(13) On two-section extension ladders the minimum overlap for the two sections in use shall be as follows:

Size of ladder (feet):	*Overlap (feet)*
Up to and including 36	3
Over 36 up to and including 48	4
Over 48 up to and including 60	5

(14) Portable rung ladders with reinforced rails (see § 1910.25b (c) (2) (iii) and (3) (iv)) shall be used only with the metal reinforcement on the under side. Ladders of this type shall be used with great care near electrical conductors, since the reinforcing itself is a good conductor;

(15) No ladder shall be used to gain access to a roof unless the top of the ladder shall extend at least 3 feet above the point of support, at eave, gutter, or roof line;

(16) Adjustment of extension ladders shall only be made by the employee when standing at the base of the ladder, so that the employee may observe when the locks are properly engaged. Adjustment of extension ladders from the top of the ladder (or any level over the locking device) is a dangerous practice and shall not be done. Adjustment shall not be made while the employee is standing on the ladder.

(17) Middle and top sections of sectional or window cleaner's ladders shall not be used for bottom section unless the employer equips them with safety shoes.

(18) Extension ladders shall always be erected so that the upper section is resting on the bottom section.

(19) The employer shall equip all portable rung ladders with nonslip bases when there is a hazard of slipping. Nonslip bases are not a substitute for care in safely placing, lashing, or holding a ladder that is being used upon oily, metal, concrete, or slippery surfaces.

(20) The bracing on the back legs of step ladders is designed solely for increasing stability and not for climbing.

(21) When service conditions warrant, hooks shall be attached at or near the top of portable ladders to give added security.

TABLE D-5—CLASSIFICATION OF VARIOUS SPECIES OF WOOD ACCEPTABLE FOR USE IN LADDERS

The species are listed alphabetically within each group. The position of any species within a group therefore bears no relation to its strength or acceptability.

Where ladders are desired for use under conditions favorable to decay, it is recommended that the heartwood of decay-resistant species be used, or that the wood be given a treatment with a wood preservative. The species having the most durable heartwood are marked with an asterisk (*), and these should be preferred where resistance to decay is required.

GROUP 1

The allowable fiber stress in bending for the species listed herein when used for side rails shall not exceed 2,150 pounds per square inch. These species may be substituted for Group 3 woods on the following basis: The dimensions may be not more than 10 percent smaller for each cross-section dimension, or the thickness may remain unchanged, in which case the width may not be more than 15 percent smaller if used edgewise (as in a rail) or 25 percent smaller if used flatwise (as in a tread).

White ash	Fraxinus americana, pennsylvanica, quadrangulata
Beech	Fagus grandifolia
Birch	Betula lenta, alleghaniensis, nigra (2)
Rock elm	Ulmus thomasii
Hickory	Carya ovata, laciniosa, tomentosa, glabra
Locust*	Robinia pseudoacacia, Gleditsia triacanthos
Hard maple	Acer nigrum, saccharum
Red maple	Acer rubrum (3)
Red oak	Quercus velutina, marilandica, kelloggii, falcata var. pagodaefolia, laurifolia, ellipsoidalis, rubra, nuttallii, palustris, coccinea, shumardii, falcata, laevis, phellos
White oak	Quercus arizonica, douglasii, macrocarpa, lobata, prinus, muehlenbergii, emoryi, gambelii, oblongifolia, virginiana, garryana, lyrata, stellata, michauxii, bicolor, alba
Pecan	Carya illinoensis, cordiformis, myristicaeformis (4), aquatics (4)
Persimmon	Diospyros virginiana

GROUP 2

The allowable fiber stress in bending for the species listed herein when used for side rails shall not exceed 2,000 pounds per square inch. These species may be substituted for Group 3 woods on the following basis: The dimensions may be not more than 7½ percent smaller for each cross-section dimension, or the thickness may remain unchanged, in which case the width may be not more than 11 percent smaller if used edgewise (as in a rail) or 20 percent smaller if used flatwise (as in a tread).

Douglas fir (coast region)	Pseudotsuga menziesii
Western larch	Larix occidentalis
Southern yellow pine.	Pinus taeda, palustris, echinata, elliotii, rigida, virginiana

GROUP 3

The allowable fiber stress in bending for the species listed herein when used for side rails shall not exceed 1,600 pounds per square inch.

Red alder	Alnus ruba, rhombifolia (2)
Oregon ash	Fraxinus latifolia
Pumpkin ash	Flaxinus profunda
Alaska cedar*	Chamaecyparis nootkatensis
Port Oxford cedar.*	Chamaecyparis lawsoniana

NOTE 4: This species is not included under this common name in American Lumber Standards nomenclature, but strength data are available and it is accordingly included in this classification.

§ 1910.25 Definitions.

(a) As used in the sections under the centerhead "Portable Wood Ladders", unless the context requires otherwise, portable wood ladder terms shall have the meanings assigned in this section.

(b) *Ladders.*—A ladder is an appliance usually consisting of two side rails joined at regular intervals by crosspieces called steps, rungs, or cleats, on which a person may step in ascending or descending.

(c) *Stepladder.*—A stepladder is a self-supporting portable ladder, nonadjustable in length, having flat steps and a hinged back. Its size is designated by the overall length of the ladder measured along the front edge of the side rails.

(d) *Single ladder.*—A single ladder is a non-self-supporting portable ladder, nonadjustable in length, consisting of but one section. Its size is designated by the overall length of the side rail.

(e) *Extension ladder.*—An extension ladder is a non-self-supporting portable ladder adjustable in length. It consists of two or more sections traveling in guides or brackets so arranged as to permit length adjustment. Its size is designated by the sum of the lengths of the sections measured along the side rails.

(f) *Sectional ladder.*—A sectional ladder is a non-self-supporting portable ladder, nonadjustable in length, consisting of two or more sections of ladder so constructed that the sections may be combined to function as a single ladder. Its size is designated by the overall length of the assembled sections.

(g) *Trestle ladder.*—A trestle ladder is a self-supporting portable ladder, nonadjustable in length, consisting of two sections hinged at the top to form equal angles with the base. The size is designated by the length of the side rails measured along the front edge.

(h) *Extension trestle ladder.*—An extension trestle ladder is a self-supporting portable ladder, adjustable in length, consisting of a trestle ladder base and a vertically adjustable single ladder, with suitable means for locking the ladders together. The size is designated by the length of the trestle ladder base.

(i) *Special-purpose ladder.*—A special-purpose ladder is a portable ladder which represents either a modification or a combination of design or construction features in one of the general purpose types of ladders previously defined, in order to adapt the ladder to special or specific uses.

(j) *Trolley ladder.*—A trolley ladder is a semifixed ladder, nonadjustable in length, supported by attachments to an overhead track, the plane of the ladder being at right angles to the plane of motion.

(k) *Side-rolling ladder.*—A side-rolling ladder is a semifixed ladder, nonadjustable in length, supported by attachments to a guide rail, which is generally fastened to shelving, the plane of the ladder being also its plane of motion.

(l) *Wood characteristics.*—Wood characteristics are distinguishing features which by their extent and number determine the quality of a piece of wood.

(m) *Wood irregularities.*—Wood irregularities are natural characteristics in or on wood that may lower its durability, stength, or utility.

(n) *Cross grain.*—Cross grain (slope of grain) is a deviation of the fiber direction from a line parallel to the sides of the piece.

(o) *Knot.*—A knot is a branch or limb, imbedded in the tree and cut through in the process of lumber manufacture, classified according to size, quality, and occurrence. The size of the knot is determined as the average diameter on the surface of the piece.

(p) *Pitch and bark pockets.*—A pitch pocket is an opening extending parallel to the annual growth rings containing, or that has contained, pitch, either solid or liquid. A bark pocket is an opening between annual growth rings that contains bark.

(q) *Shake.*—A shake is a separation along the grain, most of which occurs between the rings of annual growth.

(r) *Check.*—A check is a lengthwise separation of the wood, most of which occurs across the rings of annual growth.

(s) *Wane.*—Wane is bark, or the lack of wood from any cause, on the corner of a piece.

(t) *Decay.*—Decay is disintegration of wood substance due to action of wood-destroying fungi. It is also known as dote and rot.

(u) *Compression failure.*—A compression failure is a deformation (buckling) of the fibers due to excessive compression along the grain.

(v) *Compression wood.*—Compression wood is an aberrant (abnormal) and highly variable type of wood structure occurring in softwood species. The wood commonly has density somewhat higher than does normal wood, but somewhat lower stiffness and tensile strength for its weight in addition to high longitudinal shrinkage.

(w) *Low density.*—Low-density wood is exceptionally light in weight and usually deficient in strength properties for the species.

Portable Metal Ladders

§ 1910.26a Requirements.

(a) *General.*—Specific design and construction requirements are not a part of sections under the centerhead "Portable Metal Ladders" because of the wide variety of metal and design possibilities. However, the design shall be such as to produce a ladder without structural defects or accident hazards such as sharp edges, burrs, etc. The metal selected shall be of sufficient strength to meet the test requirements, and shall be protected against corrosion unless inherently corrosion resistant. The employer shall obtain reasonable assurances that the design requirements of this section are met.

(1) Because of the varied conditions, and the wide variety of ladder uses, ladders may be designed with parallel side rails, with side rails varying uniformly in separation along the length (tapered), or with side rails flaring at the base to increase stability.

(2) The design of the side rails shall be such as to insure a product which will conform to the requirements of this section.

(3) The spacing of rungs or steps shall be on 12-inch centers.

(4) Rungs or steps to side rail connections shall be so constructed as to insure rigidity as well as strength.

(5) Rungs and steps shall be corrugated, knurled, dimpled, coated with skid-resistant material, or otherwise treated to minimize the possibility of slipping.

(6) Hardware shall meet strength requirements of the ladder's component parts, and shall be of a material that is protected against corrosion unless it is inherently corrosion-resistant. Metals shall be so selected as to avoid excessive galvanic action.

(b) *General specifications-straight and extension ladders.*—(1) The minimum width between side rails of a straight ladder or any section of an extension ladder shall be 12 inches.

(2) The length of single ladders or individual sections of ladders shall not exceed 30 feet. Two-section ladders shall not exceed 46 feet in length and over two-section ladders shall not exceed 60 feet in length.

(3) Based on the nominal length of the ladder each section of a multisection ladder shall overlap the adjacent section by at least the number of feet stated in the following:

Nominal length of ladder (feet):	*Overlap (feet)*
Up to and including 36	3
Over 36, up to and including 48	4
Over 43, up to 60	5

(4) Extension ladders shall be equipped with positive stops which will insure the overlap specified in the table above.

(5) (i) Extension ladders may be equipped with a rope and pulley. Any rope and pulley shall be securely attached to the ladder in such a manner as not to weaken either the rungs or the side rails. The pulley shall be not less than 1¼ inches in diameter.

(ii) The rope used with the pulley shall be not less than five-sixteenths inch in diameter, having a minimum breaking strength of 560 pounds, and shall be of sufficient length for the purpose intended.

(c) *General specifications—stepladders.*—(1) Stepladders shall be designed and constucted to give a minimum slope of 3½ inches per foot of length of the front section, and a minimum slope of 2 inches per foot of length of the back section, except that special ladders designed for straight-in-wall work shall maintain at least 1¼ inch back slope per foot of length.

(2) The minimum width between the side rails at the top step shall be 12 inches. The width spread of the side rails shall increase a minimum of 1 inch per foot of length. The width of the step or tread shall not be less than 3 inches.

(3) The length of a stepladder is measured by the length of the front rail. To be classified as a standard length ladder, the measured length shall be within plus or minus one-half inch of the specified length. Stepladders shall not exceed 20 feet in length.

(4) The pail shelf shall be designed to fold completely within the ladder.

(5) The back section may be designed with either rungs or cross bracing as long as it meets the general and testing requirements.

(6) Steps shall be corrugated, knurled, dimpled, coated with skid-resistant materials, or otherwise treated to minimize the possibility of slipping.

(7) The bottoms of the four rails shall be supplied with insulating nonslip material for the safety of the user.

(8) A metal spreader or locking device of sufficient size and strength to securely

hold the front and back sections in the open position shall be a component of each stepladder. The spreader shall have all sharp points or edges covered or removed to protect the employee.

(d) *General specifications—trestles and extension trestle ladders.*—(1) Trestle ladders or extension sections or base sections of extension trestle ladders shall be not more than 20 feet in length.

(2) The minimum distance between side rails of the trestle or extension sections or base section at the narrowest point shall not be less than 12½ inches. The width spread shall not be less than one inch per foot of length of side rail.

(3) Spread of base when section is open shall not be less than 5½ inches per foot of base section side rail.

(4) The extension locking device shall be designed to withstand all load tests.

(5) A metal spreader or locking device of sufficient size and strength to securely hold the front and back sections in the open position shall be a component of each trestle ladder. The spreader shall have all sharp points or edges covered or removed to protect the employee.

(e) *General specifications—platfrom ladders.*—(1) The length of a platform ladder shall not exceed 20 feet. The length of a platform ladder shall be measured along the front rail from the floor to the platform.

(2) Minimum width between side rails at platform level shall be 14 inches. Width spread shall not be less than 1 inch per foot of rise.

(3) Slope of the front rail when unit is in open position shall not be less than 3½ inches per foot of rise, and the back section shall have a minimum slope of 1 inch per foot of rise.

(4) The platform shall be at least 20 inches from the top of the ladder, and shall have an area of not less than 200 square inches nor more than 400 square inches.

(5) The back legs and side rails of a platform ladder shall extend at least 20 inches above the platform and shall be connected with the top member to form a three-sided top guard rail, or equivalent construction shall be provided.

(6) Spreaders shall be provided where the hinging apparatus is not designed to lock the unit open.

§ 1910.26b Testing.

(a) *General.*—The tests in this section are intended to insure uniform testing methods for metal ladders. The employer shall obtain reasonable assurances that the prescribed test methods have been applied, when the employer does not perform the testing.

(b) *Straight and extension ladders.*—(1) Ladder inclined strength is measured by placing the ladder unit in a flat, horizontal position supported 6 inches from the ends of the side rails. When testing extensions, the unit is opened to the required overlap. A load of 200 pounds is applied equally to the side rails at the center of the unit by means of a beam. The ladder shall withstand this test with no permanent deformation or other visible weakening of the structure. This test is based on a 200-pound man using the ladder, set at 75½° to the ground. With the man on the center rung, the component of his 200-pound weight at right angles to the ladder will be 50 pounds. Applying the load factor of 4, the test weight becomes 200 pounds.

(2) Test unit need only be of sufficient length for test purposes, and is to consist of the base and fly sections of an extension ladder with all the hardware or fittings attached. The ladder unit is placed in a vertical position and a downward load of 775 pounds equally distributed on the ends of the side rails of the upper portion of the test unit. The unit shall withstand this test with no permanent deformation or other visible weakening of the structure.

(3) A test unit of at least three rungs is to be used from the maximum width portion of the ladder. A load of 800 pounds shall be applied to a 3½ inch wide block resting on the center of the widest rung. A rung of 14 inches or less in length shall withstand this test with no permanent deformation or other visible weakening of the structure. A rung of more than 14 inches in length may have a permanent deflection of not more than one-eighth inch provided the rung cross section is not deformed and there is no other visible weakening of the structure.

(4) With at least a three-rung test unit set in a vertical position, a load of 800 pounds shall be applied to a 3½ inch wide block resting on the center rung as near to the side rail as possible. On removing the load, the unit shall show no indication of failure in the fasteners attaching the rungs to the side rail.

(5) The rung shall be so secured to the side rail that a torque load of 360 inch-pounds applied to the rung at a side rail shall cause no visible relative motion between the rung and the side rail.

(6) With the ladder extended to its maximum working length, and resting horizontally on level supports located 6 inches from each end of the ladder, a weight of 50 pounds shall be suspended from one of the side rails midway between supports. The deflection of the loaded rail, and the difference in deflection between the loaded and unloaded rails shall not exceed the values in Table D–6.

(7) Deflections in Table D–6 are to be determined by measuring at the midpoint between supports, the distance from the outside edges of both rails to the floor or other reference surface both before and after the test load of 50 pounds is applied to one rail of the ladder. The test is to be repeated, loading the other rail of the ladder. The angle (a) between the loaded and unloaded rails and the horizontal is to be calculated from the trigonometric equation:

$$\text{Sine } a = \frac{\text{Difference in deflection}}{\text{Ladder width}}$$

(c) *Step, trestle, extension trestle, and platform ladders.*—(1) (i) Load test of the entire ladder is made with the ladder in an open position, and an 800-pound load applied to the center of the top. Resistance to a side rail bending is tested by placing an 800-pound load on the center of the middle step. The strength of the step section is tested by applying an 800-pound load to a 3½ inch-wide block resting on the center of the longest or bottom step. The pail shelf shall be so constructed as to support a distributed load of 50 pounds.

(ii) In each test case, the unit shall withstand the load without failure or permanent deformation.

(2) Set ladder in open position on a level floor. Place a 200-pound distributed load on the top step. The ladder is then subjected to a horizontal pulling load, applied at the top step, of 12-pound force to the side; 58-pound force to the front; 33-pound force to the back. In each test, all side rails shall remain on the floor.

TABLE D-6—TABLE OF DEFLECTIONS

Length of ladder in feet	Maximum deflection of loaded rail in inches	Maximum difference in deflection between loaded and unloaded rails in degrees from horizontal
20	3.0	3.6
24	3.8	4.7
28	4.6	5.4
32	5.5	5.7
36	6.4	6.1
40	7.2	6.5
44	8.0	6.5
48	8.8	6.5

§ 1910.26c Care and maintenance of ladders.

(a) *General.*—To get maximum safety good safe practices in the use and care of ladder equipment shall be used by the employer. The rules in this section are considered essential to the safety of the employees.

(b) *Care of ladders.*—(1) Ladders, like any tool, shall be handled with care and not be subjected to unnecessary dropping, jarring, or misuse.

(2) Ladders shall be stored on racks when not in use. The racks shall have sufficient supporting points to prevent any possibility of excessive sagging.

(3) Ladders transported on vehicles shall be properly supported. Supporting points shall be of a softer material, such as hardwood or rubber-covered iron pipe, to minimize the chafing and effects of road shock.

(4) Ladders used by employees shall be maintained in good condition. Hardware fittings and accessories shall be checked frequently and kept in good condition.

(5) Ropes or cables shall be inspected frequently and replaced if defective.

(6) Complete ladder inspection shall be performed with reasonable frequency. If a ladder is involved in any of the following, immediate inspection shall be made:

(i) If a ladder tips over, the ladder shall be inspected for side rail dents or bends, or excessively dented rungs, all rung-to-side-rail connections, hardware connections, and rivets shall be inspected.

(ii) If a ladder is exposed to excessive heat as in the case of fire, the ladder shall be inspected visually for damage and tested for deflection and strength characteristics.

(iii) If a ladder is to be subjected to highly corrosive acids or alkali solutions, a protective coating such as asphalt and varnish shall be applied to the equipment.

(iv) If a ladder is exposed to oil or grease or other slippery materials, it shall be cleaned of oil, grease, or slippery materials.

(7) Any ladder having a defect likely to prejudice the safety of an employee using the ladder is to be marked and taken out of service until repaired.

(c) *Use of ladders.*—(1) Portable non-self-supporting ladders shall be erected at a pitch providing the maximum balance and strength. Generally, this is a pitch of 75½ degrees. A simple guide for setting up a ladder at the proper angle is to place the base a distance from the vertical wall equal to one-fourth the working length of the ladder.

(2) A portable ladder shall be treated as a one-man working ladder based on a 200-pound load.

(3) The ladder-base section shall be placed with a secure footing, such as that provided by the use of safety shoes or a foot-ladder board on hard slick surfaces.

(4) The top of the ladder shall be placed with the two rails supported, unless the ladder is equipped with a single support attachment. Such an attachment shall be substantial and large enough to support the ladder under load.

(5) When ascending or descending, the climber shall face the ladder.

(6) Ladders shall not be tied or fastened together to provide longer sections, except by the hardware fittings which make the ladders safe for an endorsement by a manufacturer for extended uses. Suitability of a hardware fastener for this purpose shall establish an inference of compliance with this standard.

(7) Ladders shall not be used as a brace, skid, guy or gin pole, gangway, or for other uses than that for which they were intended, unless they are specifically recommended for use by the manufacturer and the employer has ready and available evidence of this recommendation.

(8) Employers shall caution employees to take proper safety measures when metal ladders are used in areas containing electric circuits to prevent short circuits or electrical shock.

§ 1910.26d Definitions.

As used in the sections under the centerhead entitled "Portable Metal Ladders", unless the context requires otherwise, portable metal ladders terms shall have the following meanings:

(a) *Ladder.*—A ladder is an appliance usually consisting of two side rails joined at regular intervals by cross pieces called steps, rungs, or cleats, on which a person may step in ascending or descending.

(b) *Step ladder.*—A step ladder is a self-supporting portable ladder, nonadjustable in length, having flat steps and a hinged back. Its size is designated by the overall length of the ladder measured along the front edge of the side rails.

(c) *Single ladder.*—A single ladder is a non-self-supporting portable ladder, nonadjustable in length, consisting of but one section. Its size is designated by the overall length of the side rail.

(d) *Extension ladder.*—An extension ladder is a non-self-supporting portable ladder adjustable in length. It consists of two or more sections traveling in guides or brackets so arranged as to permit length adjustment. Its size is designated by the sum of the lengths of the sections measured along the side rails.

(e) *Platform ladder.*—A self-supporting ladder of fixed size with a platform provided at the working level. The size is determined by the distance along the front rail from the platform to the base of the ladder.

(f) *Sectional ladder.*—A sectional ladder is a non-self-supporting portable ladder, non-adjustable in length, consisting of two or more sections so constructed that the sections may be combined to function as a single ladder. Its size is designated by the overall length of the assembled sections.

(g) *Trestle ladder.*—A trestle ladder is a self-supporting portable ladder, nonadjustable in length, consisting of two sections, hinged at the top to form equal angles with the base. The size is designated by the length of the side rails measured along the front edge.

(h) *Extension trestle ladder.*—An extension trestle ladder is a self-supporting portable ladder adjustable in length, consisting of a trestle ladder base and a vertically adjustable single ladder, with suitable means for locking the ladders together. The size is designated by the length of the trestle ladder base.

(i) *Special-purpose ladder.*—A special-purpose ladder is a portable ladder which represents either a modification or a combination of design or construction features in one of the general-purpose types of ladders previously defined, in order to adapt the ladder to special or specific uses.

Fixed Ladders

§ 1910.27 General application.

The sections under the centerhead "Fixed Ladders" prescribe minimum requirements for the structural soundness and use of fixed ladders. The sections do not apply to portable wood, metal or other types of special ladders, job-made ladders, or to special-purpose types of ladders on structures used for storage of water, grains, or animal feed, nor to ladders attached to structures when the ladders are used only for maintenance, fire-fighting, or emergency escape purposes. Further, the sections do not apply to electrical power transmission-line towers; oil or gas well drilling or pumping derricks, triangulation, radio, television, and microwave antenna communications towers and structures used exclusively for the support of these facilities, chimneys or stacks, manholes to underground utilities and facilities.

§ 1910.27a Definitions.

As used in the sections under the centerhead "Fixed Ladders", fixed ladder terms shall have the meanings set forth in this section, unless the context clearly indicates differently:

(a) *Ladder.*—A ladder is an appliance usually consisting of two side rails joined at regular intervals by crosspieces called steps, rungs, or cleats, on which a person may step in ascending or descending.

(b) *Fixed ladder.*—A fixed ladder is a ladder permanently attached to a structure, building, or equipment.

(c) *Individual-rung or step ladder.*—An individual-rung or step ladder is a fixed ladder each rung or step of which is individually attached to a structure, building, or equipment, or manhole.

(d) *Rail ladder.*—A rail ladder is a fixed ladder consisting of side rails joined at regular intervals by rungs or cleats and fastened in full length or in sections to a building, structure, or equipment.

(e) *Railings.*—A railing is any one or a combination of those railings constructed in accordance with § 1910.23; a standard railing is a vertical barrier erected along exposed edges of floor openings, wall openings, ramps, platforms, and runways to prevent falls of persons.

(f) *Pitch.*—Pitch is the included angle between the horizontal and the ladder measured on the opposite side of the ladder from the climbing side.

(g) *Fastenings.*—A fastening is a device to attach a ladder to a structure, building, or equipment.

(h) *Rungs.*—Rungs are ladder crosspieces on which a person may step in ascending or descending.

(i) *Cleats.*—Cleats are ladder crosspieces of rectangular cross-section places on edge on which a person may step in ascending or descending.

(j) *Steps.*—Steps are the cross-pieces of a ladder on which a person may step in ascending or descending.

(k) *Cage.*—A cage is a guard that may be referred to as a cage or basket guard which is an enclosure that is fastened to the side rails of the fixed ladder or to the structure to encircle the climbing space of the ladder.

(l) *Well.*—A well is a permanent complete enclosure around a fixed ladder.

(m) *Ladder safety device.*—A ladder safety device is any device, designed to eliminate or reduce the possibility of accidental falls and which may incorporate such features as life belts, friction brakes, and sliding attachments.

(n) *Grab bars.*—Grab bars are individual handholds placed adjacent to or as an extension above ladders for the purpose of providing access beyond the limits of the ladder.

(o) *Through ladder.*—A through ladder is one from which a man getting off at the top must step through the ladder in order to reach the landing.

(p) *Side-step ladder.*—A side-step ladder is one from which a man getting off at the top must step sideways from the ladder in order to reach the landing.

§ 1910.27b Design requirements.

(a) *Design considerations.*—All ladders, and fastenings used by an employer

shall be designed to meet the following load requirements:

(1) The minimum design live load shall be a single concentrated load of 200 pounds.

(2) The number and position of additional concentrated live-load units of 200 pounds each as determined from anticipated usage of the ladder shall be considered in the design.

(3) The live loads imposed by persons occupying the ladder shall be considered to be concentrated at such points as will cause the maximum stress in the structural member being considered.

(4) The weight of the ladder and attached appurtenances together with the live load shall be considered in the design of rails and fastenings.

(b) *Design stresses.*—Design stresses for wood components of ladders shall not exceed those specified in the sections of this part prescribing standards for portable wood ladders. All wood parts of fixed ladders shall meet the requirements of § 1910.25a.

(c) For fixed ladders consisting of wood side rails and wood rungs or cleats, used at a pitch in the range 75 degrees to 90 degrees, and intended for use by no more than one person per section, single ladders are permitted.

(d) An employer shall obtain reasonable assurances that the design requirements of this section have been met concerning ladders and fasteners used by his employees.

§ 1910.27c Specific features.

(a) *Rungs and cleats.*—(1) All rungs shall have a minimum diameter of three-fourths inch for metal ladders or of material of equivalent strength except as covered in paragraph (g)(1) of this section, and a minimum diameter of 1⅛ inches for wood ladders.

(2) The distance between rungs, cleats, and steps shall not exceed 16 inches and shall be uniform throughout the length of the ladder.

(3) The minimum clear length of rungs or cleats shall be 12 inches.

(4) Rungs, cleats, and steps shall be free of splinters, sharp edges, burrs, or projections which may be a hazard.

(5) The rungs of an individual-rung ladder shall be so designed that the foot cannot slide off the end. A suggested design is shown in figure D–1.

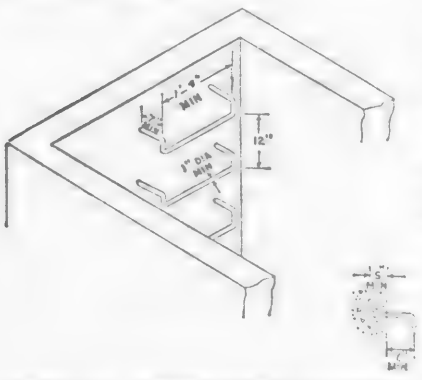


FIGURE D–1.—Suggested design for rungs on individual-rung ladders.

(b) *Side rails.*—Side rails which may be used as a climbing aid shall of such cross sections as to afford adequate gripping surface without sharp edges, splinters, or burrs.

(c) *Fastenings.*—Fastenings shall be an integral part of fixed ladder design.

(d) *Splices.*—All splices made by whatever means shall meet design requirements as stated in § 1910.27(b). All splices and connections shall have smooth transition with original members with no sharp or extensive projections.

(e) *Electrolytic action.*—Adequate means shall be employed to protect dissimilar metals from electrolytic action when such metals are joined.

(f) *Welding.*—All welding shall be in accordance with the "Code for Welding in Building Construction" (AWSD1.0–1966).

(g) *Protection from deterioration.*—(1) Metal ladders and appurtenances shall be painted or otherwise treated to resist corrosion and rusting when its location makes such treatment appropriate. Ladders formed by individual metal rungs imbedded in concrete, which serve as access to pits and to other areas under floors, are frequently located in an atmosphere that causes corrosion and rusting. Such individual metal rungs shall have a minimum diameter of 1 inch or shall be painted or otherwise treated to resist corrosion and rusting.

(2) Wood ladders, when used under conditions where decay may occur, shall be treated with a nonirritating preservative, and the details shall be such as to prevent or minimize the accumulation of water on wood parts.

(3) When different types of materials are used in the construction of a ladder, the materials used shall be so treated as to have no deleterious effect one upon the other.

§ 1910.27d Clearance.

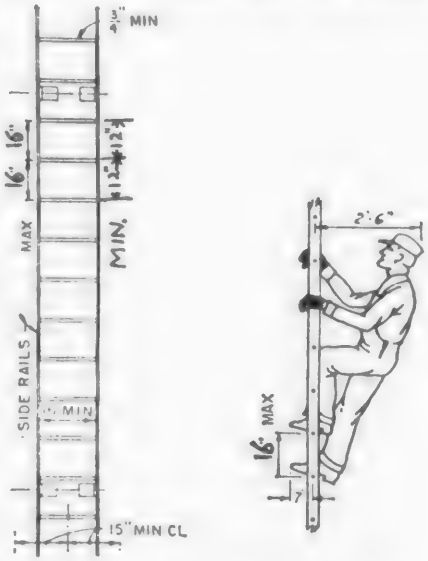
(a) *Climbing side.*—On fixed ladders, the perpendicular distance from the centerline of the runs to the nearest permanent object on the climbing side of the ladder shall be 36 inches for a pitch of 76 degrees, and 30 inches for a pitch of 90 degrees, and (fig. D–2 of this section), with minimum clearances for intermediate pitches varying between these two limits in proportion to the slope, except as provided in paragraphs (c) and (e) of this section.

(b) *Ladders without cages or wells.*—A clear width of at least 15 inches when possible, shall be provided each way from the centerline of the ladder in the climbing space, except when cages or wells are used.

(c) *Ladders with cages or baskets.*—Ladders equipped with cage or basket are excepted from the provisions of paragraphs (a) and (b) of this section, but shall conform to the provisions of § 1910.27e(a)(5). Fixed ladders in smooth-walled wells are excepted from the provisions of paragraph (a) of this section, but shall conform to the provisions of § 1910.27e(a)(6).

(d) *Clearance in back of ladder.*—The distance from the centerline of rungs, cleats, or steps to the nearest permanent object in back of the ladder shall be not less than 7 inches, when possible, except that when unavoidable obstructions are encountered, minimum clearances as shown in figure D–3 shall be provided.

(e) *Clearance in back of grab bar.*—The distance from the centerline of the grab bar to the nearest permanent object in back of the grab bars shall be not less than 4 inches. Grab bars shall not protrude on the climbing side beyond the rungs of the ladder which they serve.



RAIL LADDER WITH BAR STEEL RAILS AND ROUND STEEL RUNGS

FIG. D-2

Minimum Ladder Clearances

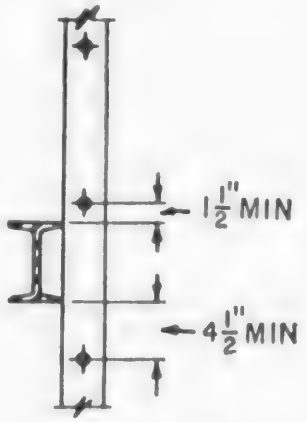


FIG. D-3

Clearance for Unavoidable Obstruction at Rear of Fixed Ladder

(f) *Step-across distance.*—The step-across distance from the nearest edge of ladder to the nearest edge of equipment or structure shall be not more than 12 inches, or less than 2½ inches (fig. D–4)

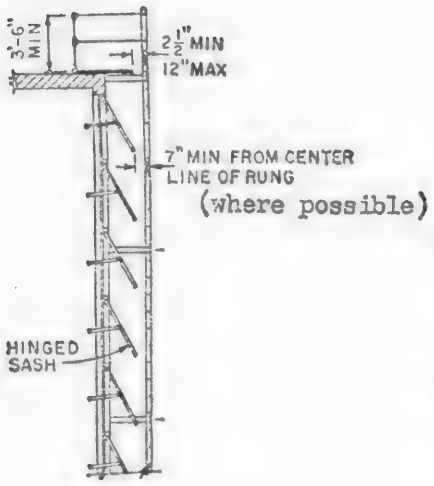


FIG. D-4
Ladder Far from Wall

(g) *Hatch cover.*—Counterweighted hatch covers shall open a minimum of 60 degrees from the horizontal. The distance from the centerline of rungs or cleats to the edge of the hatch opening on the climbing side shall be not less than 24 inches from offset wells or 30 inches for straight wells. There shall be no protruding potential hazards within 24 inches of the centerline of rungs or cleats; any such hazards within 30 inches of the centerline of the rungs or cleats shall be fitted with deflector plates placed at an angle of 60 degrees from the horizontal as indicated in figure D–5

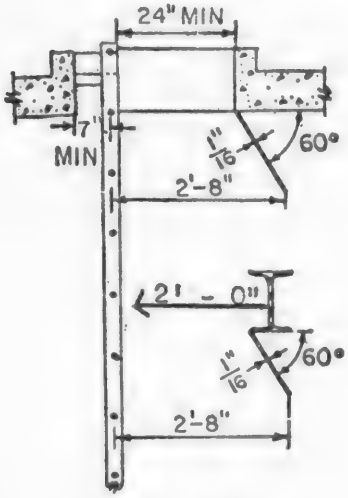
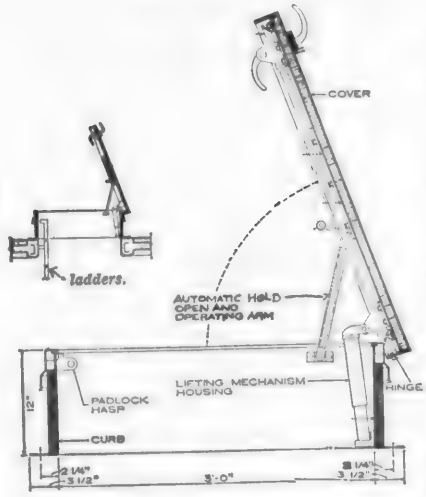


FIG. D-5
Deflector Plates for Head Hazards

The relationship of a fixed ladder to an appropriately counterweighted hatch cover is illustrated in figure D–6.



Relationship of Fixed Ladder to a Safe Access Hatch

Fig. D-6

§ 1910.27e Special requirements.

(a) *Cages or wells.*—(1) Cages or wells (when used) shall be built, as shown on the applicable drawings, covered in detail in figures D–7, D–8, and D–9, or of equivalent construction.

(2) Cages or wells (except as provided in paragraph (e) of this section) conforming to the dimensions shown in figures D–7, D–8, and D–9 shall be provided on ladders of more than 20 feet to a maximum unbroken length of 30 feet.

(3) Cages shall extend a minimum of 42 inches above the top of landing, unless protection is provided.

(4) Cages shall extend down the ladder to a point not less than 7 feet nor more than 8 feet above the base of the ladder, with bottom flared not less than 4 inches.

(5) Cages shall not extend less than 27 nor more than 28 inches from the centerline of the rungs of the ladder. Cage shall not be less than 27 inches in width. The inside shall be clear of projections. Vertical bars shall be located at a maximum spacing of 40 degrees around the circumference of the cage; this will give a maximum spacing of approximately 9½ inches, center to center.

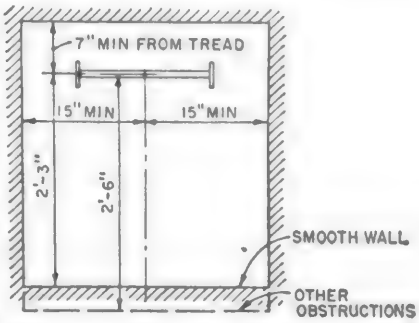
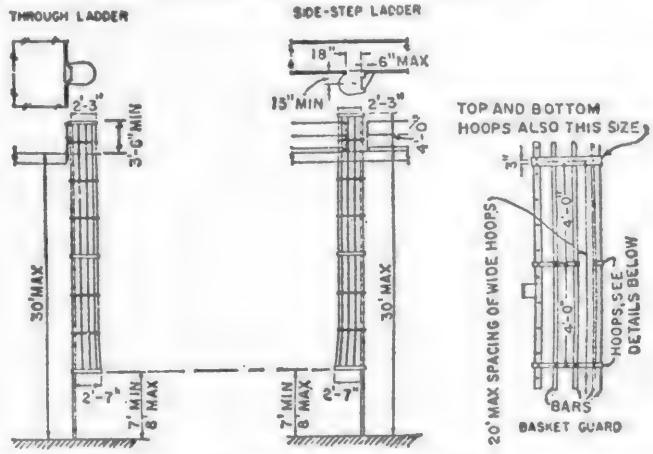


FIGURE D–7.—Clearance diagram for fixed ladder in well.



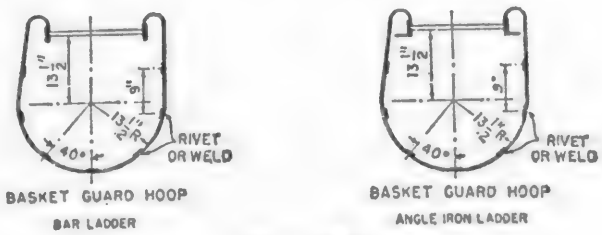


FIG. D-8
Cages for Ladders More Than 20 Feet High

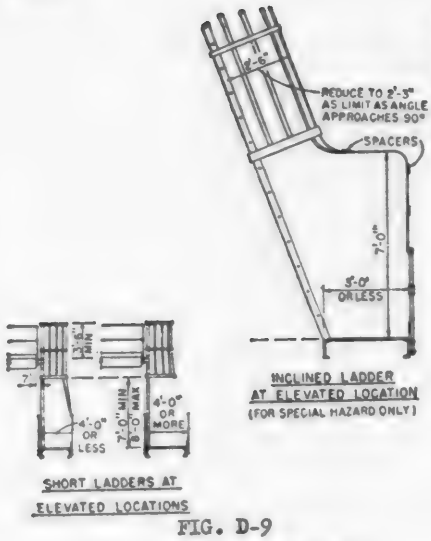

REDUCE TO 2'-3" AS LIMIT AS ANGLE APPROACHES 90°
SPACERS
7'-0"
5'-0" OR LESS
INCLINED LADDER AT ELEVATED LOCATION (FOR SPECIAL HAZARD ONLY)
4'-0" OR LESS
4'-0" OR MORE
SHORT LADDERS AT ELEVATED LOCATIONS

FIG. D-9

Cages — Special Applications

(6) Ladder wells shall have a clear width of at least 15 inches measured each way from the centerline of the ladder. Smooth-walled wells shall be a minimum of 27 inches from the centerline of rungs to the well wall on the climbing side of the ladder.

(b) *Landing platforms.*—When ladders are used to ascend to heights exceeding 20 feet, landing platforms shall be provided for each 30 feet of height or fraction thereof, except that, where no cage, well, or ladder safety device is provided, landing platforms shall be provided for each 20 feet of height or fraction thereof. Each ladder section shall be offset from adjacent sections. Where installation conditions (even for a short, unbroken length) require that adjacent sections be offset, landing platforms shall be provided at each offset.

(2) Where user has to step a distance greater than 12 inches from the centerline of the rung of a ladder to the nearest edge of structure or equipment, a landing platform shall be provided. The minimum step-across distance shall be 2½ inches.

(3) All landing platforms shall be equipped with standard railings and toeboards, so arranged as to give safe access to the ladder. Platforms shall be not less than 24 inches in width and 30 inches in length.

(4) One rung of any section of ladder shall be located at the level of the landing laterally served by the ladder. Where access to the landing is through the ladder, the same rung spacing as used on the ladder shall be used from the landing platform to the first rung below the landing.

(c) *Ladder extensions.*—The side rails of through or side-step ladder extensions shall extend 3½ feet above any landing or other walking surface. For through ladder extensions, the rungs shall be omitted from the extension and shall have not less than 18 nor more than 24 inches clearance between rails. For side-step or offset fixed ladder sections at landings, the side rails and rungs shall be carried to the next regular rung beyond or above the 3½ feet minimum (fig. D–10).

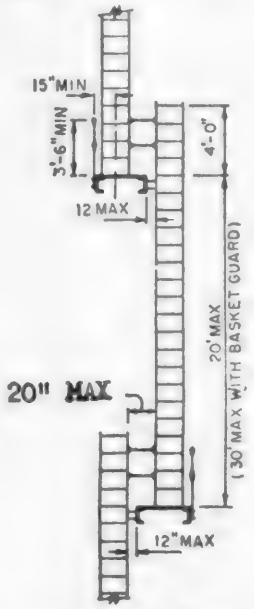


FIG. D-10

Offset Fixed Ladder Sections

(d) *Grab bars.*—Grab bars shall be spaced by a continuation of the rung spacing when they are located in the horizontal position. Vertical grab bars shall have the same spacing as the ladder side rails. Grab-bar diameters shall be the equivalent of the round-rung diameters.

(e) *Ladder safety devices.*—Ladder safety devices may be used on ladders in lieu of cage protection. No landing platform is required in these cases. All ladder safety devices such as those that incorporate lifebelts, friction brakes, and sliding attachments shall meet the design requirements of the ladder which they serve.

§ 1910.27f Pitch.

(a) *Preferred pitch.*—The preferred pitch of fixed ladders shall be considered to come in the range of 75 degrees and 90 degrees with the horizontal (fig. D–11).

(b) *Pitch.*—Fixed ladders within the pitch range of 60 and 75 degrees with the horizontal are permitted only where it is found necessary to meet conditions of installation. Lesser pitch ranges are not permissible.

(c) *Pitch greater than 90 degrees.*—Ladders having a pitch in excess of 90 degrees with the horizontal are prohibited.

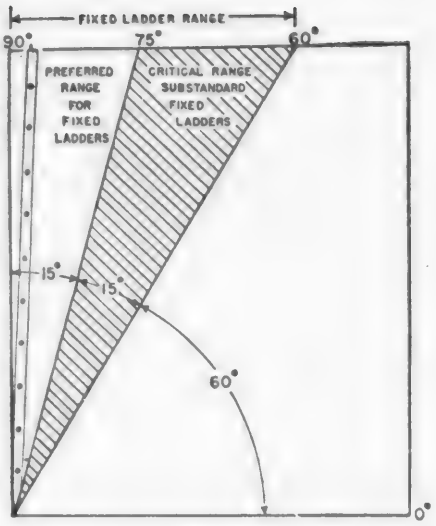


FIG. D-11

Pitch of Fixed Ladders

§ 1910.27g Manhole steps and ladders.

(a) Entrance into a manhole shall be by steps that are cast or mortared into the walls of riser or conical top sections or by portable ladder. Portable ladders shall conform to the requirements of §§ 1910.25 and 1910.26.

(b) Manhole steps that are cast or mortared into the walls of riser or conical top sections shall meet the following requirements:

(1) For steps, appurtenances and fastenings, the minimum design live load shall be a single concentrated load of 300 lbs.

(2) The live loads imposed by employees occupying the steps shall be considered to be concentrated at the such points as will cause the maximum stress in the structural member being considered.

(3) Steps in riser and conical top sections shall be aligned in each section so as to form a continuous ladder with steps equally spaced vertically in the assembled manhole at a maximum design distance of 16 inches apart. Steps shall be so designed that the foot cannot slide off the end.

(4) Steps shall be embedded in the riser or conical top section wall a minimum distance of 3 inches.

(5) When dissimilar types of materials are used in the steps, appurtenances and fastenings, the materials shall be treated to prevent deleterious effects.

(6) The portion of the step projecting into the riser or cone opening shall be free of any hazardous sharp edges, burrs, or projections.

(7) Ferrous metal steps not painted or treated to resist corrosion shall have a minimum cross sectional dimension of 1 inch.

(8) The minimum length of steps shall be 10 inches.

(9) The step shall project a minimum clear distance of 4 inches from the wall of the riser or cone section measured from the point of embedment.

§ 1910.27(h) Maintenance.

The employer shall maintain all ladders in a safe condition; i.e., a condition which is otherwise required under this Subpart D. All ladders shall be inspected with reasonable frequency. A reasonable frequency of inspections depends upon the use and exposure of the ladders.

SAFETY REQUIREMENTS FOR SCAFFOLDING

§ 1910.28a General requirements for scaffolds.

(a) (1) Scaffolds shall be furnished in accordance with the sections under the centerhead "Safety Requirements for Scaffolding" for employees engaged in work that cannot be done safely from the ground or from solid construction.

(2) The requirements of these sections on the use of scaffolding apply to operation, and use of scaffolds in other than construction operations. Requirements for construction, alteration, and repair of buildings or works, including painting or decorating, are to be found in Subpart L of Part 1926 of this chapter. In this regard, see § 1910.12, which applies Part 1926 of this chapter to such activities. In situations where the work contemplated by a standard is not normally performed by the employer, or when it is performed by a manufacturer the employer shall nevertheless obtain reasonable assurances that the standard has been met.

(b) This section and the remaining sections under the centerhead "Safety Requirements for Scaffolding" shall not apply when ladders conforming to the requirements of this Subpart D are used.

(c) When it is not practicable to install and use guardrails for employee protection on scaffolds as required by this section, safety belts, which are properly secured to a lanyard and life line or a safety net properly installed, may be used instead of scaffold guardrails.

(d) The footing or anchorage for scaffolds shall be sound, rigid, and capable of carrying the maximum intended load without settling or displacement. Unstable objects such as barrels, boxes, loose brick, or concrete blocks shall not be used to support scaffolds or planks.

(e) (1) Guardrails and toeboards shall be installed on all open sides and ends of platforms more than 10 feet above the ground or floor except:

(i) Scaffolding wholly within the interior of a building and covering the entire floor area of any room therein and not having any side exposed to a hoistway, elevator shaft or other wall opening, stairwell, or other floor openings, and

(ii) Needle-beam scaffolds and floats in use by structural iron workers.

(2) Guardrails shall be 2 x 4 inches or the equivalent, installed no less than 36 inches or not more than 42 inches nominal high, with a midrail, when required, of 1- x 4-inch lumber or equivalent. Supports shall be at intervals not to exceed ten feet. Toeboards shall be a minimum of 4 inches in height.

(f) Scaffolds and their components shall be capable of supporting without failure at least four times the maximum intended load.

(g) Scaffolds and other devices mentioned or described in this section shall be maintained in safe condition. Scaffolds shall not be altered or moved horizontally while they are in use or occupied.

(h) Any scaffold damaged or weakened from any cause shall be repaired and shall not be used until repairs have been completed.

(i) Scaffolds shall not be loaded in excess of the working load for which they are intended.

(j) All load-carrying timber members of scaffold framing shall be a minimum of 1,500 f. (Stress Grade) construction grade lumber. All dimensions are nominal sizes as provided in the American Lumber Standards, except that where rough sizes are noted, only rough or undressed lumber of the size specified will satisfy minimum requirements.

NOTE.—Where nominal sizes of lumber are used in place of rough sizes, the nominal size lumber shall be such as to provide equivalent strength to that specified in tables D–7 through D–12 and D–16.

(k) All planking shall be scaffold Grade as recognized by grading rules for the species of wood used.

(l) Nails or bolts used in construction of scaffolds shall be of adequate size and in sufficient numbers at each connection to develop the designed strength of the scaffold. Nails shall not be subjected to a straight pull and shall be be driven their full length.

(m) All planking or platforms shall be overlapped (minimum 12 inches) or secured from movement.

(n) An access ladder or equivalent safe access shall be provided.

(o) Scaffold planks shall extend over their end supports not less than 6 inches nor more than 18 inches and shall be laid tightly with their edges close together extending across the entire bearer from pole to pole. The scaffold planks shall be laid tightly with no opening greater than one inch through which tools or materials can fall.

(p) The poles, legs, or uprights of scaffolds shall be plumb, securely and rigidly braced to prevent swaying and displacement.

(q) Materials being hoisted onto a scaffold shall have a tag line or some other method of equivalent effect shall be used to control the load.

(r) Overhead protection shall be provided for men on a scaffold exposed to overhead hazards.

(s) Scaffolds shall be provided with a screen in the opening between the toeboard and the guardrail, with the screen extending along the entire opening. The screen shall consist of No. 19 gauge U.S. Standard Wire one-half-inch mesh, or other material of equivalent strength for the protection of employees who are required to work or pass under the scaffolds.

(t) Employees shall not be permitted to work on scaffolds during storms or high winds.

(u) Employees shall not be permitted to work on scaffolds covered with ice or snow, except that employees may be permitted to work under such conditions for the purpose of removing ice or snow from a scaffold in order to eliminate the hazardous condition.

(v) Tools, materials, and debris shall not be allowed to accumulate on a scaffold in quantities sufficient to cause a hazard.

(w) Only treated or protected fiber rope shall be used for or near any work involving the use of corrosive substances or chemicals.

(x) Wire or fiber rope used for scaffold suspension shall be capable of supporting at least six times the intended load.

(y) When acid solutions are used for cleaning buildings wire rope supported scaffolds shall be used.

(z) The use of shore scaffolds or lean-to scaffolds is prohibited.

(aa) Lumber sizes, when used in this section, refer to nominal sizes except where otherwise stated.

(bb) Scaffolds shall be secured to permanent structures, through use of anchor bolts, reveal bolts, or other equivalent means. Window cleaners' anchor bolts shall not be used.

(cc) Special precautions shall be taken to protect scaffold members, including any wire or fiber ropes, when using a heat-producing process.

§ 1910.28b General requirements for wood pole scaffolds.

(a) Scaffold poles shall bear on a foundation of sufficient size and strength to spread the load from the poles over a sufficient area to prevent settlement. All poles shall be set plumb.

(b) Where wood poles are spliced, the ends shall be squared and the upper section shall rest squarely on the lower section. Wood splice plates shall be provided on at least two adjacent sides and shall not be less than 4 feet 0 inches in length, overlapping the abutted ends equally, and have the same width and not less than the cross-sectional area of the pole. Splice plates of other materials of equivalent strength may be used.

(c) Independent pole scaffolds shall be set as near to the wall of the building as practicable.

(d) All pole scaffolds shall be securely guyed or tied to the building or structure. Where the height or length exceeds 25 feet, the scaffold shall be secured at intervals not greater than 25 feet vertically and horizontally.

(e) Putlogs or bearers shall be set with their greater dimensions vertical, long enough to project over the ledgers of the inner and outer rows of poles at least 3 inches for proper support.

(f) Every wooden putlog on single pole scaffolds shall be reinforced with a

$\frac{3}{16}$ x 2-inch steel strip or equivalent secured to its lower edge throughout its entire length.

(g) Ledgers shall be long enough to extend over two pole spaces. Ledgers shall not be spliced between the poles. Ledgers shall be reinforced by bearing blocks securely nailed to the side of the pole to form a support for the ledger.

(h) Diagonal bracing shall be provided to prevent the poles from moving in a direction parallel with the wall of the building, or from buckling.

(i) Cross bracing shall be provided between the inner and outer sets of poles in independent pole scaffolds. The free ends of pole scaffolds shall be cross braced.

(j) Full diagonal face bracing shall be erected across the entire face of pole scaffolds in both directions. The braces shall be spliced at the poles.

(k) Platform planks shall be laid with their edges close together so the platform will be tight with no spaces through which tools or fragments of material can fall.

(l) Where planking is lapped, each plank shall lap its end supports at least 12 inches. Where the ends of planks abut each other to form a flush floor, the butt joint shall be at the centerline of a pole. The abutted ends shall rest on separate bearers. Intermediate beams shall be provided where necessary to prevent dislodgment of planks due to deflection, and the ends shall be nailed or cleated to prevent their dislodgment.

(m) When a scaffold turns a corner, the platform planks shall be laid to prevent tipping. The planks that meet the corner putlog at an angle shall be laid first, extending over the diagonally placed putlog far enough to have a good safe bearing, but not far enough to involve any danger from tipping. The planking running in the opposite direction at right angles shall be laid so as to extend over and rest on the first lay of planking.

(n) When moving platforms to the next level, the old platform shall be left undisturbed until the new putlogs or bearers have been set in place, ready to receive the platform planks.

(o) Guardrails not less than 2 x 4 inches or the equivalent and not less than 36 inches or more than 42 inches nominal high, with a mid-rail, when required, of 1 x 4-inch lumber or equivalent, and toeboards, shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with § 1910.28a(s).

(p) All wood pole scaffolds 60 feet or less in height shall be constructed and erected in accordance with tables D–7 through D–12 of this Subpart D. If they are over 60 feet in height they shall be designed by a registered professional engineer and constructed and erected in accordance with such design.

(q) Wood-pole scaffolds shall not be erected beyond the reach of effective firefighting apparatus.

TABLE D-7—MINIMUM NOMINAL SIZE AND MAXIMUM SPACING OF MEMBERS OF SINGLE POLE SCAFFOLDS LIGHT DUTY

	Maximum height of scaffold	
	20 feet	60 feet
Uniformly distributed load	Not to exceed 25 pounds per square foot.	
Poles or uprights	2 by 4 in	4 by 4 in.
Pole spacing (longitudinal)	6 ft. 0 in	10 ft. 0 in.
Maximum width of scaffold	5 ft. 0 in	5 ft. 0 in.
Bearers or putlogs to 3 ft. 0 in. width	2 by 4 in	2 by 4 in.
Bearers or putlogs to 5 ft. 0 in. width	2 by 6 in. or 3 by 4 in	2 by 6 in. or 3 by 4 in. (rough).
Ledgers	1 by 4 in	1¼ by 9 in.
Planking	1¼ by 9 in. (rough)	2 by 9 in.
Vertical spacing of horizontal members	7 ft. 0 in	7 ft. 0 in.
Bracing, horizontal and diagonal	1 by 4 in	1 by 4 in.
Tie-ins	1 by 4 in	1 by 4 in.
Toeboards	4 in. high (minimum)	4 in. high (minimum).
Guardrail	2 by 4 in	2 by 4 in.

All members except planking are used on edge.

TABLE D–8—MINIMUM NOMINAL SIZE AND MAXIMUM SPACING OF MEMBERS OF SINGLE POLE SCAFFOLDS

MEDIUM DUTY

Uniformly distributed load.	Not to exceed 50 pounds per square foot.
Maximum height of Scaffold.	60 ft.
Poles or uprights	4 by 4 in.
Pole spacing (longitudinal).	8 ft. 0 in.
Maximum width of scaffold.	5 ft. 0 in.
Bearers or putlogs	2 by 9 in. or 3 by 4 in.
Spacing of bearers or putlogs.	8 ft. 0 in.
Ledgers	2 by 9 in.
Vertical spacing of horizontal members.	9 ft. 0 in.
Bracing, horizontal	1 by 6 in. or 1¼ by 4 in.
Bracing, diagonal	1 by 4 in.
Tie-ins	1 by 4 in.
Planking	2 by 9 in.
Toeboards	4 in. high (minimum).
Guardrail	2 by 4 in.

All members except planking are used on edge.

TABLE D–9—MINIMUM NOMINAL SIZE AND MAXIMUM SPACING OF MEMBERS OF SINGLE POLE SCAFFOLDS

HEAVY DUTY

Uniformly distributed load.	Not to exceed 75 pounds per square foot.
Maximum height of Scaffold.	60 ft.
Poles or uprights	4 by 4 in.
Pole spacing (longitudinal).	6 ft. 0 in.
Maximum width of scaffold.	5 ft. 0 in.
Bearers or putlogs	2 by 9 in. or 3 by 5 in. (rough).
Spacing of bearers or putlogs.	6 ft. 0 in.
Ledgers	2 by 9 in.
Vertical spacing of horizontal members.	6 ft. 6 in.
Bracing, horizontal and diagonal.	2 by 4 in.
Tie-ins	1 by 4 in.
Planking	2 by 9 in.
Toeboards	4 in. high (minimum).
Guardrail	2 by 4 in.

All members except planking are used on edge.

TABLE D-10—MINIMUM NOMINAL SIZE AND MAXIMUM SPACING OF MEMBERS OF INDEPENDENT POLE SCAFFOLDS LIGHT DUTY

	Maximum height of scaffold	
	20 feet	60 feet
Uniformly distributed load	Not to exceed 25 pounds per square foot.	
Poles or uprights	2 by 4 in	4 by 4 in.
Pole spacing (longitudinal)	6 ft. 0 in	10 ft. 0 in.
Pole spacing (transverse)	6 ft. 0 in	10 ft. 0 in.
Ledgers	1¼ by 4 in	1¼ by 9 in.
Bearers to 3 ft. 0 in. span	2 by 4 in	2 by 4 in.
Bearers to 10 ft. 0 in. span	2 by 6 in. or 3 by 4 in	2 by 9 (rough) or 3 by 8 in.
Planking	1¼ by 9 in	2 by 9 in.
Vertical spacing of horizontal members	7 ft. 0 in	7 ft. 0 in.
Bracing, horizontal and diagonal	1 by 4 in	1 by 4 in.
Tie-ins	1 by 4 in	1 by 4 in.
Toeboards	4 in. high	4 in. high (minimum).
Guardrail	2 by 4 in	2 by 4 in.

All members except planking are used on edge.

TABLE D–11—MINIMUM NOMINAL SIZE AND MAXIMUM SPACING OF MEMBERS OF INDEPENDENT POLE SCAFFOLDS

MEDIUM DUTY

Uniformly distributed load.	Not to exceed 50 pounds per square foot.
Maximum height of scaffold.	60 ft.
Poles or uprights	4 by 4 in.
Pole spacing (longitudinal).	8 ft. 0 in.
Pole spacing (transverse).	8 ft. 0 in.
Ledgers	2 by 9 in.
Vertical spacing of horizontal members.	6 ft. 0 in.
Spacing of bearers	8 ft. 0 in.
Bearers	2 by 9 in. (rough) or 2 by 10 in.
Bracing, horizontal	1 by 6 in. or 1¼ by 4 in.
Bracing, diagonal	1 by 4 in.
Tie-ins	1 by 4 in.
Planking	2 by 9 in.
Toeboards	4 in. high (minimum).
Guardrail	2 by 4 in.

All members except planking are used on edge.

TABLE D–12—MINIMUM NOMINAL SIZE AND MAXIMUM SPACING OF MEMBERS OF INDEPENDENT POLE SCAFFOLDS

HEAVY DUTY

Uniformly distributed load.	Not to exceed 75 pounds per square foot.
Maximum height of scaffold.	60 ft.
Poles or uprights	4 by 4 in.
Pole spacing (longitudinal).	6 ft. 0 in.
Pole spacing (transverse).	8 ft. 0 in.
Ledgers	2 by 9 in.
Vertical spacing of horizontal members.	4 ft. 6 in.
Bearers	2 by 9 in. (rough).
Bracing, horizontal and diagonal.	2 by 4 in.
Tie-ins	1 by 4 in.
Planking	2 by 9 in.
Toeboards	4 in. high (minimum).
Guardrail	2 by 4 in.

All members except planking are used on edge.

TABLE D–13—TUBE AND COUPLER SCAFFOLDS LIGHT DUTY

Uniformly distributed load	Not to exceed 25 p.s.f.
Post spacing (longitudinal)	10 ft. 0 in.
Post spacing (transverse)	6 ft. 0 in.

Working levels	Additional planked levels	Maximum height
1	8	125 ft.
2	4	125 ft.
3	0	91 ft. 0 in.

TABLE D–14—TUBE AND COUPLER SCAFFOLDS MEDIUM DUTY

Uniformly distributed load	Not to exceed 50 p.s.f.
Post spacing (longitudinal)	8 ft. 0 in.
Post spacing (transverse)	6 ft. 0 in.

Working levels	Additional planked levels	Maximum height
1	6	125 ft.
2	0	73 ft. 0 in.

TABLE D–15—TUBE AND COUPLER SCAFFOLDS HEAVY DUTY

Uniformly distributed load	Not to exceed 75 p.s.f.
Post spacing (longitudinal)	6 ft. 6 in.
Post spacing (traverse)	6 ft. 0 in.

Working levels	Additional planked levels	Maximum height
1	6	125 ft.

§ 1910.28c Tube and coupler scaffolds.

(a) A light-duty tube and coupler scaffold shall have all posts, bearers, runners, and bracing of nominal 2-inch O.D. steel tubing. The posts shall be spaced not more than 6 feet apart by 10 feet along the length of the scaffold. Other structural metals may be used but such metal must be designed to carry an equivalent load.

(b) A medium-duty tube and coupler scaffold shall have all posts, runners, and bracing of nominal 2-inch O.D. steel tubing. Posts spaced not more than 6 feet apart by 8 feet along the length of the scaffold shall have bearers of nominal 2½ inch O.D. steel tubing. Posts spaced not more than 5 feet apart by 8 feet along the length of the scaffold shall have bearers of nominal 2-inch O.D. steel tubing. Other structural metals when used must be designed to carry an equivalent load.

(c) A heavy-duty tube and coupler scaffold shall have all posts, runners, and bracing of nominal 2-inch O.D steel tubing, with the posts spaced not more than 6 feet apart by 6 feet 6 inches along the length of the scaffold. Other structural metals may be used but must be designed to carry an equivalent load.

(d) Tube and coupler scaffolds shall be limited in heights and working levels to those permitted in tables D–13, 14 and 15, of this section. Drawings and specifications of all tube and coupler scaffolds above the limitations in Tables D–13, 14, and 15 of this section shall be designed by a registered professional engineer and copies made available to the employer for inspection purposes.

(e) All tube and coupler scaffolds shall be constructed and erected to support four times the maximum intended loads as set forth in Tables D–13, 14, and 15 of this section, or as set forth in the specifications by a registered professional engineer copies which shall be made available to the employer for inspection purposes.

(f) All tube and coupler scaffolds shall be erected by a designated competent person.

(g) Posts shall be accurately spaced, erected on suitable bases, and maintained plumb.

(h) Runners shall be erected along the length of the scaffold located on both the inside and the outside posts at even height. Runners shall be interlocked to form continuous lengths and coupled to each post. The bottom runners shall be located as close to the base as possible. Runners shall be placed not more than 6 feet 6 inches on centers.

(i) Bearers shall be installed transversely between posts and shall be securely coupled to the posts bearing on the runner coupler. When coupled directly to the runners, the coupler must be kept as close to the posts as possible.

(j) Bearers shall be at least 4 inches but not more than 12 inches longer than the post spacing or runner spacing. Bearers may be cantilevered for use as brackets to carry not more than two planks.

(k) Cross bracing shall be installed across the width of the scaffold at least every third set of posts horizontally and every fourth runner vertically. Such bracing shall extend diagonally from the inner and outer runners upward to the next outer and inner runners.

(l) Longitudinal diagonal bracing shall be installed at approximately a 45-degree angle from near the base of the first outer post upward to the extreme top of the scaffold. Where the longitudinal length of the scaffold permits, such bracing shall be duplicated beginning at every fifth post. In a similar manner longitudinal diagonal bracing shall also be installed from the last post extending back and upward toward the first post. Where conditions preclude the attachment of this bracing to the posts, it may be attached to the runners.

(m) The entire scaffold shall be tied to and securely braced against the building at intervals not to exceed 30 feet horizontally and 26 feet vertically.

(n) Guardrails not less than 2x4 inches or the equivalent and not less than 36 inches or more than 42 inches nominal high, with a mid-rail, when required, of 1x4-inch lumber or equivalent, and toeboards, shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with § 1910.28a (s).

§ 1910.28d Tubular welded frame scaffolds.

(a) Metal tubular frame scaffolds, including accessories such as braces, brackets, trusses, screw legs, and ladders, shall be designed and proved to support safely four times the maximum intended load.

(b) Spacing of panels or frames shall be consistent with the loads imposed.

(c) Scaffolds shall be properly braced by cross bracing or diagonal braces, or both, for securing vertical members together laterally, and the cross braces shall be of such length as will automatically square and align vertical members so that the erected scaffold is always plumb, square, and rigid. All brace connections shall be made secure.

(d) Scaffold legs shall be set on adjustable bases or plain bases placed on mud sills or other foundations adequate to support the maximum intended load.

(e) The frames shall be placed one on top of the other with coupling or stacking pins to provide proper vertical alinement of the legs.

(f) Where uplift may occur, panels shall be locked together vertically by pins or other equivalent suitable means.

(g) Guardrails not less than 2 x 4 inches or the equivalent and not less than 36 inches or more than 42 inches nominal high, with a mid-rail, when required, of 1- x 4- inch lumber or equivalent, and toeboards shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with § 1910.28a(s).

(h) All tubular metal scaffolds shall be constructed and erected to support four times the maximum intended loads.

(i) To prevent movement, the scaffold shall be secured to the building or structure at intervals not to exceed 30 feet horizontally and 26 feet vertically.

(j) Planking shall be in conformity with § 1910.28a(k).

(k) Drawings and specifications for all frame scaffolds over 125 feet in height above the base plates shall be designed by a registered professional engineer, and copies of the drawings and specifications shall be available for inspection purposes.

(l) All tubular welded frame scaffolds shall be erected by a designate competent person.

(m) Frames and accessories for scaffolds shall be maintained in good repair. Any noncompliance with matters otherwise required by this subpart shall be immediately corrected before further use of the scaffold. Any broken, bent, excessively rusted, altered, or otherwise structurally damaged frames or accessories shall not be used.

(n) Inspections of frames and accessories shall be made by the employer with reasonable frequency to assure compliance with the requirements of the sections of this subpart relating to scaffolds. A reasonable frequency will depend on the circumstances governing the particular use of the scaffolding.

§ 1910.28e Outrigger scaffolds.

(a) Outrigger beams shall extend not more than 6 feet beyond the face of the building. The inboard end of outrigger beams measured from the fulcrum point to the extreme point of support, shall be not less than one and one-half times the outboard end in length. The beams shall rest on edge, the sides shall be plumb, and the edges shall be horizontal. The fulcrum point of the beam shall rest on a secure bearing at least 6 inches in each horizontal dimension. The beam shall be secured in place against movement and shall be securely braced at the fulcrum point against tipping.

(b) The inboard ends of outrigger beams shall be securely supported either by means of struts bearing against sills in contact with the overhead beams or ceiling, or by means of tension members secured to the floor joists underfoot, or by both if necessary. The inboard ends of outrigger beams shall be secured against tipping and the entire supporting structure shall be securely braced in both directions to prevent any horizontal movement.

(c) Unless outrigger scaffords are designed by a registered professional engineer, they shall be constructed and erected in accordance with table D–16. Outrigger scaffolds designed by a registered professional engineer shall be constructed and erected in accordance with such design. A copy of the detailed drawings and specifications showing the sizes and spacing of members shall be kept on the job.

(d) Planking shall be laid tight and shall extend to within 3 inches of the building wall. Planking shall be nailed or bolted to outriggers.

(e) Where there is danger of material falling from the scaffold, a wire mesh or other enclosure shall be provided between the guardrail and the toeboard.

(f) Where additional working levels are required to be supported by the outrigger method, the plans and specifications of the outrigger and scaffolding structure shall be designed by a registered professional engineer.

TABLE D–16—MINIMUM NOMINAL SIZE AND MAXIMUM SPACING OF MEMBERS OF OUTRIGGER SCAFFOLDS

	Light duty	Medium duty
Maximum scaffold load	25 p.s.f.	50 p.s.f.
Outrigger size	2 x 10 in.	3 x 10 in.
Maximum outrigger spacing	10 ft 0 in	6 ft 0 in.
Planking	2 x 9 in.	2 x 9 in.
Guardrail	2 x 4 in.	2 x 4 in.
Guardrail uprights	2 x 4 in.	2 x 4 in.
Toeboards	4 in. (minimum).	4 in. (minimum).

§ 1910.28f Masons' adjustable multiple-point suspension scaffolds.

(a) The scaffold shall be capable of sustaining a working load of 50 pounds per square foot and shall not be loaded in excess of that figure.

(b) The scaffold shall be provided with hoisting machines that meet nationally recognized testing standards, such as those of Underwriters' Laboratories Inc. or Factory Mutual Research Corp.

(c) The platform shall be supported by wire ropes in conformity with § 1910.28a(x), suspended from overhead outrigger beams.

(d) The scaffold outrigger beams shall consist of structural metal securely fastened or anchored to the frame of the building or structure.

(e) Each outrigger beam shall be equivalent in strength to at least a standard 7-inch, 15.3-pound steel I-beam, be at least 15 feet long, and shall not project more than 6 feet 6 inches beyond the bearing point.

(f) Where the overhang exceeds 6 feet 6 inches, outrigger beams shall be composed of stronger beams or multiple beams and be installed in accordance with the approved designs and instructions of a registered professional engineer.

(g) If channel iron outrigger beams are used in place of I-beams, they shall be securely fastened together with the flanges turned out.

(h) All outrigger beams shall be set and maintained with their webs in a vertical position.

(i) A stop bolt shall be placed at each end of every outrigger beam.

(j) The outrigger beam shall rest on suitable wood-bearing blocks.

(k) All parts of the scaffold such as bolts, nuts, fittings, clamps, wire rope, and outrigger beams and their fastenings, shall be maintained in sound and good working condition and shall be inspected before each installation and periodically thereafter.

(l) The free end of the suspension wire ropes shall be equipped with proper size thimbles and be secured by splicing or other equivalent means. The running ends shall be securely attached to the hoisting drum and at least four turns of rope shall at all times remain on the drum.

(m) When single outrigger beam is used, the steel shackles or clevises with which the wire ropes are attached to the outrigger beams shall be placed directly over the hoisting drums.

(n) The scaffold platform shall be equivalent in strength to at least 2-inch planking.

(o) Guardrails not less than 2 x 4 inches or the equivalent and not less than 36 inches or more than 42 inches nominal high, with a mid-rail, when required, of 1 x 4-inch lumber or equivalent, and toe boards, shall be installed at all open sides on all scaffolds more than 10 feet above the ground floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with § 1910.28a(s).

(p) Overhead protection shall be provided on the scaffold, not more than 9 feet above the platform, consisting of 2-inch planking or material of equivalent strength laid tightly, when employees are at work on the scaffold and an overhead hazard exists.

(q) Each scaffold shall be installed or relocated in accordance with designs and instructions, of a registered professional engineer, and supervised by a competent designated person.

§ 1910.28g Two-point suspension scaffolds (swinging scaffolds).

(a) Two-point suspension scaffold platforms shall be not less than 20 inches nor more than 36 inches wide overall. The platform shall be securely fastened to the hangers by U-bolts or by other equivalent means.

(b) The hangers of two-point suspension scaffolds shall be made of wrought iron, mild steel, or other equivalent material having a cross-sectional area capable of sustaining four times the maximum intended load, and shall be designed with a support for guardrail, intermediate rail, and toeboard.

(c) When hoisting machines are used on two-point suspension scaffolds, such machines shall be of a design tested and approved by a nationally recognized testing laboratory, such as Underwriters' Laboratories, Inc. or Factory Mutual Research Corp., using nationally recognized testing standards.

(d) The roof irons or hooks shall be of wrought iron, mild steel, or other equivalent materials of proper size and

design, in good condition and securely installed. Tie-backs of three-fourth inch diameter manila rope or the equivalent shall serve as a secondary means of anchorage, installed at approximately right angles to the face of the building or structure and secured to a structurally sound portion of the building.

(e) Outrigger beams, when used, shall consist of structural metal securely fastened to the frame of the building or structure.

(f) Any outrigger beams which are used shall be equivalent in strength to at least a standard 7 inch, 15.3-pound steel I-beam; shall be at least 15 feet long; and shall not project more than 6 feet 6 inches beyond the bearing point.

(g) Where the overhang exceeds 6 feet 6 inches, outrigger beams shall be composed of stronger beams or multiple beams and be in accordance with designs and instructions approved by a registered professional engineer.

(h) If two-channel iron outrigger beams are used, they shall be securely fastened together with the flanges turned out.

(i) All outrigger beams shall be set and maintained with their webs in a vertical position.

(j) If a weight is used to counterbalance the suspended rated load on the overhang of the outrigger beam, the size of the weight, its position, arrangement, and method used to secure it shall be determined and specified by a registered professional engineer. A copy of the detailed drawings, specifications, and instructions for using weights shall be kept on the job and be available for inspection.

(k) Guardrails not less than 2 x 4 inches or the equivalent and not less than 36 inches or more than 42 inches nominal high, with a mid-rail, when required, of 1-x-4 inch lumber or equivalent, and toeboards, shall be installed at all open sides of all scaffolds, more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with § 1910.28(a)(s).

(l) Two-point suspension scaffolds shall be suspended by wire or fiber ropes. Wire and fiber ropes shall conform to § 1910.28a(x).

(m) The blocks for fiber ropes shall be of standard 6-inch size, consisting of at least one double and one single block. The sheaves of all blocks shall fit the size of rope used.

(n) All wire ropes, fiber ropes, slings, hangers, platforms, and other supporting parts shall be inspected before every installation. Periodic inspections shall be made while the scaffold is in use.

(o) On suspension scaffolds designed for a working load of 500 pounds, no more than two men shall be permitted to work at one time. On a suspension scaffold with a working load of 750 pounds, no more than three men shall be permitted to work at any one time. Each workman shall be protected by a safety lifebelt attached to a lifeline. The lifeline shall be securely attached to substantial members of the structure (not scaffold), or the securely rigged lines, which will safety suspend the workman in case of a fall.

(p) Where acid solutions are used, fiber ropes are not permitted unless they are acid-proof.

(q) Two-point suspension scaffolds shall be securely lashed to the building or structure to prevent them from swaying. Window cleaners' anchors shall not be used for this purpose.

(r) The platform of every two-point suspension scaffold shall be one of the following types:

(1) The side stringer of ladder-type platforms shall be clear straight grained spruce or materials of equivalent strength and durability. The rungs shall be of straight-grained oak, ash, or hickory, at least 1⅛ inch in diameter, with seven-eighths inch tenons mortised into the side stringers at least seven-eighths inch. The stringers shall be tied together with the tie rods not less than one-quarter inch in diameter, passing through the stringers and riveted up tight against washers on both ends. The flooring strips shall be spaced not more than five-eighths inch apart except at the side rails where the space may be 1 inch. Ladder-type platforms shall be constructed in accordance with table D–17.

(2) Plank-type platforms shall be composed of not less than nominal 2- x 8-inch unspliced planks, properly cleated together on the underside starting 6 inches from each end; intervals in between shall not exceed 4 feet. The plank-type platform shall not extend beyond the hangers more than 18 inches. A bar or other effective means shall be securely fastened to the platform at each end to prevent its slipping off the hanger. The span between hangers for plank-type platforms shall not exceed 10 feet.

(3) Beam platforms shall have side stringers of lumber not less than 2 x 6 inches set on edge. The span between hangers shall not exceed 12 feet when beam platforms are used. The flooring shall be supported on 2- x 6-inch crossbeams, laid flat and set into the upper edge of the stringers with a snug fit, at intervals of not more than 4 feet, securely nailed in place. The flooring shall be of 1- x 6-inch material properly nailed. Floorboards shall not be spaced more than one-half inch apart.

TABLE D-17—SCHEDULE FOR LADDER-TYPE PLATFORMS

	Length of platform (feet)				
	12	14 & 16	18 & 20	22 & 24	28 & 30
Side stringers, minimum cross section (finished sizes):					
At ends (in.)	1¾ x 2¾	1¾ x 2¾	1¾ x 3	1¾ x 3	1¾ x 3½
At middle (in.)	1¾ x 3¾	1¾ x 3¾	1¾ x 4	1¾ x 4½	1¾ x 5
Reinforcing strip (minimum)	A ⅛x1½-in. steel reinforcing strip or its equivalent shall be attached to the side or underside full length.				
Rungs	Rungs shall be 1⅛-in. minimum, diameter with at least ⅞-in. diameter tenons, and the maximum spacing shall be 12 in. center to center.				
Tie rods:					
Number (minimum)	3	4	4	5	6
Diameter (minimum)	¼ in.	¼ in.	¼ in.	¼ in.	¼ in.
Flooring, minimum finished size (in.)	½ x 2¾	½ x 2¾	½ x 2¾	½ x 2¾	½ x 2¾

§ 1910.28h Stone setters' adjustable multiple-point suspension scaffolds.

(a) The scaffold shall be capable of sustaining a working load of 25 pounds per square foot and shall not be overloaded. Scaffolds shall not be used for storage of stone or other heavy materials.

(b) The hoisting machine and its supports shall be of a type tested and approved using nationally recognized standards by a nationally recognized testing laboratory such as Underwriters Laboratories, Inc. or Factory Mutual Research Corp.

(c) The platform shall be securely fastened to the hangers by U-bolts or other equivalent means.

(d) The scaffold unit shall be suspended from metal outriggers, iron brackets, wire rope slings, or iron hooks which will safely support the maximum intended load.

(e) Outriggers when used shall be set with their webs in a vertical position, securely anchored to the building or structure and provided with stop bolts at each end.

(f) The scaffold shall be supported by wire rope conforming with § 1910.28a(x), suspended from overhead supports.

(g) The free ends of the suspension wire ropes shall be equipped with proper size thimbles, secured by splicing or other equivalent means. The running ends shall be securely attached to the hoisting drum and at least four turns of rope shall remain on the drum at all times.

(h) Guardrails not less than 2 by 4 inches or the equivalent and not less than 36 inches or more than 42 inches nominal high, with a mid-rail, when required, of 1- by 4-inch lumber or equivalent, and toeboards shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with § 1910.28a(s).

(i) When two or more scaffolds are used on a building or structure they shall not be bridged one to the other but shall be maintained at even height with platforms butting closely.

(j) Each scaffold shall be installed or relocated in accordance with designs and instructions of a registered professional engineer, and such installation or relocation shall be supervised by a competent designated person.

§ 1910.28i Single-point adjustable suspension scaffolds.

(a) The scaffolding, including power units or manually operated winches, shall

be of a type tested and approved using nationally recognized standards and by a nationally recognized testing laboratory, such as Underwriters' Laboratories Inc. or Factory Mutual Research Corp.

(b) The power units may be either electrically or air motor driven.

(c) All power-operated gears and brakes shall be enclosed.

(d) In addition to the normal operating brake, all-power driven units must have an emergency brake which engages automatically when the normal speed of descent is exceeded.

(e) Guards, mid-rails, and toeboards shall completely enclose the cage or basket. Guardrails shall be no less than 2 by 4 inches or the equivalent installed no less than 36 inches nor more than 42 inches above the platform. Mid-rails shall be 1 by 6 inches or the equivalent, installed equidistant between the guardrail and the platform. Toeboards shall be a minimum of 4 inches in height.

(f) The hoisting machines, cables, and equipment shall be regularly serviced and inspected after each installation and every 30 days thereafter.

(g) The units may be combined to form a two-point suspension scaffold. Such scaffold shall comply with § 1910.28g.

(h) The supporting cable shall be straight for its entire length, and the operator shall not sway the basket and fix the cable to any intermediate points to change his original path of travel.

(i) Equipment shall be maintained and used in accordance with the manufacturers' instructions.

(j) Suspension methods shall conform to applicable provisions of §§ 1910.28f and 1910.28g.

§ 1910.28j Boatswain's chairs.

(a) The chair seat shall be not less than 12 by 24 inches, and of 1-inch thickness. The seat shall be reinforced on the underside to prevent the board from splitting.

(b) The two fiber rope seat slings shall be of ⅝-inch diameter, reeved through the four seat holes so as to cross each other on the underside of the seat.

(c) Seat slings shall be of at least ⅜-inch wire rope when a workman is conducting a heat producing process such as gas or arc welding.

(d) The workman shall be protected by a safety life belt attached to a lifeline. The lifeline shall be securely attached to substantial members of the structure (not scaffold), or to securely rigged lines, which will safely suspend the employee in case of a fall.

(e) The tackle shall consist of correct size roller bearing on bushed blocks and properly spliced ⅝-inch diameter first-grade manila rope.

(f) The roof irons, hooks, or the object to which the tackle is anchored shall be securely installed. Tiebacks when used shall be installed at right angles to the face of the building and securely fastened to a chimney. Or some other structure which will safely suspend the employee in case of a fall.

§ 1910.28k Carpenters' bracket scaffolds.

(a) The brackets shall consist of a triangular wood frame not less than 2 by 3 inches in cross section, or of metal of equivalent strength. Each member shall be properly fitted and securely joined.

(b) Each bracket shall be attached to the structure by means of one of the following:

(1) A bolt no less than five-eighths inch in diameter which shall extend through the inside of the building wall.

(2) A metal stud attachment device.

(3) Welding to steel tanks.

(4) Hooking over a well-secured and adequately strong supporting member.

The brackets shall be spaced no more than 10 feet apart.

(c) No more than two persons shall occupy any given 10 feet of a bracket scaffold at any one time. Tools and materials shall not exceed 75 pounds in addition to the occupancy.

(d) The platform shall consist of not less than two 2- by 9-inch nominal size planks extending not more than 18 inches or less than 6 inches beyond each end support.

(e) Guardrails not less than 2 by 4 inches or the equivalent and not less than 36 inches or more than 42 inches nominal high, with a mid-rail, when required, of 1- by 4-inch lumber or equivalent, and toeboards, shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with § 1910.28a(s).

§ 1910.28l Bricklayers' square scaffolds.

(a) The squares shall not exceed 5 feet in width and 5 feet in height.

(b) Members shall be not less than those specified in Table D–18.

(c) The squares shall be reinforced on both sides of each corner with 1- by 6-inch gusset pieces. They shall also have braces 1 by 8 inches on both sides running from center to center of each member, or other means to secure equivalent strength and rigidity.

(d) The squares shall be set not more than 5 feet apart for medium duty scaffolds, and not more than 8 feet apart for light duty scaffolds. Bracing 1 x 8 inches, extending from the bottom of each square to the top of the next square, shall be provided on both front and rear sides of the scaffold.

TABLE D–18—MINIMUM DIMENSIONS FOR BRICKLAYERS' SQUARE SCAFFOLD MEMBERS

Members:	*Dimensions (inches)*
Bearers or horizontal members	2 by 6.
Legs	2 by 6.
Braces at corners	1 by 6.
Braces diagonally from center frame	1 by 8.

(e) Platform planks shall be at least 2- by 9-inch nominal size. The ends of the planks shall overlap the bearers of the squares and each plank shall be supported by not less than three squares.

(f) Bricklayers' square scaffolds shall not exceed two tiers in height and shall be so constructed and arranged that one square shall rest directly above the other. The upper tiers shall stand on a continuous row of planks laid across the next lower tier and be nailed down or otherwise secured to prevent displacement.

(g) Scaffolds shall be level and set upon a firm foundation.

§ 1910.28m Horse scaffolds.

(a) Horse scaffolds shall not be constructed or arranged more than two tiers or 10 feet in height.

(b) The members of the horses shall be not less than those specified in Table D–19.

(c) Horses shall be spaced not more than 5 feet for medium duty and not more than 8 feet for light duty.

(d) When arranged in tiers, each horse shall be placed directly over the horse in the tier below.

(e) On all scaffolds arranged in tiers, the legs shall be nailed down to the planks to prevent displacement or thrust and each tier shall be substantially cross braced.

TABLE D–19—MINIMUM DIMENSIONS FOR HORSE SCAFFOLD MEMBERS

Members:	*Dimensions (inches)*
Horizontal members or bearers	3 by 4.
Legs	1¼ by 4½.
Longitudinal brace between legs	1 by 6.
Gusset brace at top of legs	1 by 8.
Half diagonal braces	1¼ by 4½.

(f) Horses or parts which have become weak or defective shall not be used.

(g) Guardrails not less than 2 by 4 inches or the equivalent and not less than 36 inches or more than 42 inches nominal high with a mid-rail, when required, of 1- by 4-inch lumber or equivalent and toeboards, shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with § 1910.28a(s).

§ 1910.28n Needle beam scaffold.

(a) Wood needle beams shall be in accordance with § 1910.28a (f) and (j) and shall not be less than 4 by 6 inches in size, with the greater dimension placed in a vertical direction. Metal beams or the equivalent conforming to § 1910.28a (f) and (j) may be used.

(b) Ropes or hangers shall be provided for supports. The span between supports on the needle beam shall not exceed 10 feet for 4- by 6-inch timbers. Rope supports shall be equivalent in strength to 1-inch diameter first-grade manila rope.

(c) The ropes shall be attached to the needle beams by a scaffold hitch or a properly made eye splice. The loose end of the rope shall be tied by a bowline knot or by a round turn and one-half hitch.

(d) The platform span between the needle beams shall not exceed 8 feet when using 2-inch scaffold plank. For spans greater than 8 feet, platforms shall be designed based on design require-

ments for the special span. The overhang of each end of the platform planks shall be not less than 1 foot and not more than 18 inches.

(e) When one needle beam is higher than the other or when the platform is not level the platform shall be secured to prevent slipping.

(f) All unattached tools, bolts, and nuts used on needle beam scaffolds shall be kept in suitable containers.

(g) One end of a needle beam scaffold may be supported by a permanent structural member conforming to § 1910.28a (f) and (j).

(h) Each employee working on a needle beam scaffold 20 feet or more above the ground or floor shall be protected by a safety belt attached to a lifeline. The lifeline shall be securely attached to substantial members of the structure (not scaffold), or to securely rigged lines, which will safely suspend the employee in case of a fall.

§ 1910.28o Plasterers', decorators', and large area scaffolds.

(a) Plasterers', decorators', lathers', and ceiling workers' inside scaffolds shall be constructed in accordance with the general requirements set forth for independent wood pole scaffolds.

(b) Guardrails not less than 2 by 4 inches or the equivalent and not less than 36 inches or more than 42 inches nominal high, with a mid-rail, when required, of 1- by 4-inch lumber or equivalent, and toeboards, shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in accordance with § 1910.28a(s).

(c) All platform planks shall be laid with the edges close together.

(d) When independent pole scaffold platforms are erected in sections, such sections shall be provided with connecting runways equipped with substantial guardrails.

§ 1910.28p Interior hung scaffolds.

(a) An interior hung scaffold should be hung or suspended from the roof structure or substantial ceiling beams.

(b) The suspended steel wire rope shall conform to § 1910.28a(x). Wire may be used provided the strength requirements of § 1910.28a(x) are met.

(c) For hanging wood scaffolds, the following minimum nominal size material is recommended:

(1) Supporting bearers 2 by 9 inches on edge.

(2) Planking 2 by 9 inches with maximum span 7 feet for heavy duty and 10 feet for light duty or medium duty.

(d) Steel tube and coupler members may be used for hanging scaffolds with both types of scaffold designed to sustain a uniform distributed working load up to heavy duty scaffold loads with a safety factor of four.

(e) When a hanging scaffold is supported by means of wire rope, such wire rope shall be wrapped at least twice around the supporting members and twice around the bearers of the scaffold, with each end of the wire rope secured by at least three standard wire-rope clips.

(f) All overhead supporting members shall be inspected and checked for strength before the scaffold is erected.

(g) Guardrails not less than 2 by 4 inches or the equivalent and not less than 36 inches or more than 42 inches nominal high, with a mid-rail, when required, of 1- by 4-inch lumber or equivalent, and toeboards, shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with § 1910.28a(s).

§ 1910.28q Ladder-jack scaffolds.

(a) All ladder-jack scaffolds shall be limited to light duty and shall not exceed a height of 20 feet above the floor or ground.

(b) All ladders used in connection with ladder-jack scaffolds shall be heavy-duty ladders and shall be designed and constructed in accordance with this subpart.

(c) The ladder jack shall be so designed and constructed that it will bear on the side rails in addition to the ladder rungs, or if bearing on rungs only, the bearing area shall be at least 10 inches on each rung.

(d) Ladders used in conjunction with ladder jacks shall be so placed, fastened, held, or equipped with devices so as to prevent slipping.

(e) The wood platform planks shall be not less than 2 inches nominal in thickness. Both metal and wood platform planks shall overlap the bearing surface not less than 12 inches. The span between supports for wood shall not exceed 8 feet. Platform width shall be not less than 18 inches.

(f) No more than two persons shall occupy any given 8 feet of any ladder-Jack scaffold at any one time.

(g) Ladder-jack scaffolds shall be provided with suitable guardrails unless safety belts with lifelines are attached and provided for the employee.

§ 1910.28r Window-jack scaffolds.

(a) Window-jack scaffolds shall be used only for the purpose of working at the window opening through which the jack is placed.

(b) Window jacks shall not be used to support planks placed between one window jack and another or for other elements of scaffolding.

(c) Window-jack scaffolds shall be provided with suitable guardrails unless safety belts with lifelines are attached and provided for the employee. Window-jack scaffolds shall be used by no more than one employee.

§ 1910.28s Roofing brackets.

(a) Roofing brackets shall be constructed to fit the pitch of the roof.

(b) Brackets shall be secured in place by nailing in addition to the pointed metal projections. The nails shall be driven full length into the roof. When rope supports are used, they shall consist of first-grade manila of at least three-quarter-inch diameter, or equivalent.

(c) A substantial catch platform shall be installed below the working area of roofs more than 20 feet from the ground to eaves with a slope greater than 3 inches in 12 inches without a parapet. In width the platform shall extend 2 feet beyond the projection of the eaves and shall be provided with a standard guardrail as required by § 1910.28a(e)(2). This provision shall not apply where employees engaged in work upon such roofs are protected by a safety belt attached to a lifeline.

(d) Where employees are required to work near the edge of a flat roof or a roof with a slope no greater than 3 inches in 12 inches they shall be protected by one of the following:

(1) A catch platform as required by paragraph (c) of this section or

(2) By a standard guardrail as required by § 1910.28(e)(2) or an equivalent barrier. These guards may be of removable construction or portable guardrails if they are of equivalent strength and protection or

(3) When the nature of the work to be done on the roof is not extensive enough to justify the installation of guards as indicated above, employees shall be protected by a safety belt properly secured to prevent falling.

§ 1910.28t Crawling boards or chicken ladders.

(a) Crawling boards shall be not less than 10 inches wide and 1 inch thick, having cleats 1 x 1½ inches. The cleats shall be equal in length to the width of the board and spaced at equal intervals not to exceed 24 inches. Nails shall be driven through and clinched on the underside. The crawling board shall extend from the ridge pole to the eaves when used in connection with roof construction, repair, or maintenance.

(b) A firmly fastened lifeline of at least three-quarter-inch rope shall be strung beside each crawling board for a handhold.

(c) Crawling boards shall be secured to the roof by means of adequate ridge hooks or equivalent effective means.

§ 1910.28u Float or ship scaffolds.

(a) Float or ship scaffolds shall support not more than three men and a few light tools, such as those needed for riveting, bolting, and welding. They shall be constructed in accordance with paragraphs (b) through (f) of this section, unless substitute designs and materials provide equivalent strength, stability, and safety.

(b) The platform shall be not less than 3 feet wide and 6 feet long, made of three-quarter-inch exterior plywood.

(c) Under the platform, there shall be two supporting bearers made from 2- x 4-inch, or 1- x 10-inch rough, selected lumber, or better. They shall be free of knots or other flaws and project 6 inches beyond the platform on both sides. The ends of the platform shall extend about 6 inches beyond the outer

edges of the bearers. Each bearer shall be securely fastened to the platform.

(d) An edging of wood not less than ¾ x 1½ inches, or equivalent, shall be placed around all sides of the platform to prevent tools from rolling off.

(e) Supporting ropes shall be 1-inch diameter manila rope or equivalent, free from deterioration, chemical damage, flaws, or other imperfections. Rope connections shall be such that the platform cannot shift or slip. If two ropes are used with each float, they should be arranged so as to provide four ends which are to be securely fastened to an overhead support. Each of the two supporting ropes shall be hitched around one end of a bearer and pass under the platforms to the other end of the bearer where it is hitched again, leaving sufficient rope at each end for the supporting ties.

(f) Each workman shall be protected by a safety belt attached to a lifeline. The lifeline shall be securely attached to substantial members of the structure (not scaffold) or to securely rigged lines, which will safely suspend the workman in case of a fall.

§ 1910.28v Definitions.

As used in the sections under the centerhead "Safety Requirements for Scaffolding", the scaffolding terms shall have the meaning set forth in this section, unless the context requires otherwise:

(a) *Bearer (Putlog).*—A horizontal member of a scaffold upon which the platform rests and which may be supported by ledgers.

(b) *Boatswain's chair.*—A seat supported by slings, attached to a suspended rope, designed to accommodate one workman in a sitting position.

(c) *Brace.*—A tie that holds one scaffold member in a fixed position with respect to another member.

(d) *Bricklayers' square scaffold.*—A scaffold composed of framed wood squares which support a platform limited to light and medium duty.

(e) *Carpenters' bracket scaffold.*—A scaffold consisting of wood or metal brackets supporting a platform.

(f) *Coupler.*—A device for locking together the component parts of a tubular metal scaffold. The material used for the couplers shall be of a structural type, such as drop-forged steel, malleable iron, or structural grade aluminum. The use of gray cast iron is prohibited.

(g) *Crawling board or chicken ladder.*—A plank with cleats spaced and secured at equal intervals, for use by a worker on roofs, not designed to carry any material.

(h) *Double pole or independent pole scaffold.*—A scaffold supported from the base by a double row of uprights, independent of support from the walls and constructed of uprights, ledgers, horizontal platform bearers, and diagonal bracing.

(i) *Float or ship scaffold.*—A scaffold hung from overhead supports by means of ropes and consisting of a substantial platform having diagonal bracing underneath, resting upon and securely fastened to two parallel plank bearers at right angles to the span.

(j) *Guardrail.*—A rail secured to uprights and erected along the exposed sides and ends of platforms.

(k) *Heavy duty scaffold.*—A scaffold designed and constructed to carry a working load not to exceed 75 pounds per square foot.

(l) *Horse scaffold.*—A scaffold for light or medium duty, composed of horses supporting a work platform.

(m) *Interior hung scaffold.*—A scaffold suspended from the ceiling or roof structure.

(n) *Ladder jack scaffold.*—A light duty scaffold supported by brackets attached to ladders.

(o) *Ledger (stringer runner).*—A horizontal scaffold member which extends from post to post and which supports the putlogs or bearer forming a tie between the post.

(p) *Light duty scaffold.*—A scaffold designed and constructed to carry a working load not to exceed 25 pounds per square foot.

(q) *Manually propelled mobile scaffold.*—A portable rolling scaffold supported by casters.

(r) *Masons' adjustable multiple-point suspension scaffold.*—A scaffold having a continuous platform supported by bearers suspended by wire rope from overhead supports so arranged and operated as to permit the raising or lowering of the platform to desired working positions.

(s) *Maximum intended load.*—The total of all loads including the working load, the weight of the scaffold, and such other loads as may be reasonably anticipated.

(t) *Medium duty scaffold.*—A scaffold designed and constructed to carry a working load not to exceed 50 pounds per square foot.

(u) *Mid-rail.*—A rail approximately midway between the guardrail and platform, used when required, and secured to the uprights erected along the exposed sides and ends of platforms.

(v) *Needle beam scaffold.*—A light duty scaffold consisting of needle beams supporting a platform.

(w) *Outrigger scaffold.*—A scaffold supported by outriggers or thrustouts projecting beyond the wall or face of the building or structure, the inboard ends of which are secured inside of such a building or structure.

(x) *Putlog.*—A scaffold member upon which the platform rests.

(y) *Roofing bracket.*—A bracket used in sloped roof construction, having provisions for fastening to the roof or supported by ropes fastened over the ridge and secured to some suitable object.

(z) *Runner.*—The lengthwise horizontal bracing or bearing members or both.

(aa) *Scaffold.*—Any temporary elevated platform and its supporting structure used for supporting employees or materials or both.

(bb) *Single-point adjustable suspension scaffold.*—A manually or power-operated unit designed for light duty use, supported by a single wire rope from an overhead support so arranged and operated as to permit the raising or lowering of the platform to desired working positions.

(cc) *Single pole scaffold.*—Platforms resting on putlogs or crossbeams, the outside ends of which are supported on ledgers secured to a single row of posts or uprights and the inner ends of which are supported on or in a wall.

(dd) *Stone setters' adjustable multiple-point suspension scaffold.*—A swinging-type scaffold having a platform supported by hangers suspended at four points so as to permit the raising or lowering of the platform to the desired working position by the use of hoisting machines.

(ee) *Toeboard.*—A barrier secured along the sides and ends of a platform, to guard against the falling of material.

(ff) *Tube and coupler scaffold.*—An assembly consisting of tubing which serves as posct, bearers, braces, ties, and runners, a base supporting the posts, and special couplers which serve to connect the uprights and to join the various members.

(gg) *Tubular welded frame scaffold.*—A sectional, panel, or frame metal scaffold substantially build up of prefabricated welded sections which consist of posts and horizontal bearer with intermediate members. Panels or frames shall be braced with diagonal or cross braces.

(hh) *Two-point suspension scaffold (swinging scaffold).*—A scaffold, the platform of which is supported by hangers (stirrups) at two points, suspended from overhead supports so as to permit the raising or lowering of the platform to the desired working position by tackle or hoisting machines.

(ii) *Window jack scaffold.*—A scaffold, the platform of which is supported by a bracket or jack which projects through a window opening.

(jj) *Working load.*—Load imposed by men, materials, and equipment.

(kk) *Floor.*—The main level or bottom or lower part of a room or space, on which an employee stands, as distinguished from a scaffold or platform or other narrower structure except that this does not include a flat roof.

(ll) *Roof.*—The cover of any building or the top of any building.

MANUALLY PROPELLED MOBILE LADDER STANDS AND SCAFFOLDS (TOWERS)

§ 1910.29a General requirements.

(a) The sections under the centerhead "Manually Propelled Mobile Ladder Stands and Scaffolds (Towers)" are intended to prescribe requirements for the design, construction, and use of mobile work platforms (including ladder stands but not including aerial ladders) and rolling (mobile) scaffolds (towers). The purpose is to protect employees using this equipment from hazards. When an employer is not immediately involved in matters relating to the design and construction of the equipment, he shall obtain reasonable assurances that the requirements of these sections have been met.

(b) *Working loads.*—(1) Work platforms and scaffolds shall be capable of carrying the design load under varying circumstances depending upon the conditions of use. Therefore, all parts and appurtenances necessary for their safe and efficient utilization must be integral parts of the design.

(2) Specific design and construction requirements are not a part of this section because of the wide variety of materials and design possibilities. However, the design shall be such as to produce a mobile ladder stand or scaffold that will safely sustain the specified loads. The material selected shall be of sufficient strength to meet the test requirements and shall be protected against corrosion or deterioration.

(i) The design working load of ladder stands shall be calculated on the basis of one or more 200-pound persons together with 50 pounds of equipment each.

(ii) The design load of all scaffolds shall be calculated on the basis of:

Light.—Designed and constructed to carry a working load of 25 pounds per square foot.

Medium.—Designed and constructed to carry a working load of 50 pounds per square foot.

Heavy.—Designed and constructed to carry a working load of 75 pounds per square foot.

All ladder stands and scaffolds shall be capable of supporting at least four times the design working load.

(3) The materials used in mobile ladder stands and scaffolds shall be of standard manufacture and conform to standard specifications of strength, dimensions, and weights, and shall be selected to safety support the design working load.

(4) Nails, bolts, or other fasteners used in the construction of ladders, scaffolds, and towers shall be of adequate size and in sufficient numbers at each connection to develop the designed strength of the unit. Nails shall be driven full length.

(5) All exposed surfaces shall be free from sharp edges, burrs or other hazards.

(c) *Work levels.*—(1) The maximum work level height shall not exceed four (4) times the minimum or least base dimension of any mobile ladder stand or scaffold. Where the basic mobile unit does not meet this requirement, suitable outrigger frames shall be employed to achieve this least base dimension, or provisions shall be made to guy or brace the unit against tipping.

(2) The minimum platform width for any work level shall not be less than 20 inches for mobile scaffolds (towers). Ladder stands shall have a minimum step width of 16 inches.

(3) The supporting structure for the work level shall be rigidly braced, using adequate cross bracing or diagonal bracing with rigid platforms at each work level.

(4) The steps of ladder stands shall be fabricated from slip resistant treads.

(5) The work level platform of scaffolds (towers) shall be of wood, aluminum, or plywood planking, steel or expanded metal, for the full width of the scaffold, except for necessary openings. Work platforms shall be secured in place. All planking shall be 2-inch (nominal) scaffold grade minimum 1,500 f. (stress grade) construction grade lumber or equivalent.

(6) All scaffold work levels 10 feet or higher above the ground or floor shall have a standard (4-inch nominal) toeboard.

(7) All work levels 10 feet or higher above the ground or floor shall have a guardrail of 2- by 4-inch nominal or the equivalent installed no less than 36 inches or more than 42 inches high, with a midrail, when required, of 1- by 4-inch nominal lumber or equivalent.

(8) A climbing ladder shall be provided for access and egress. It shall be fastened or built into the scaffold by sound design and engineering. It shall be located so that its use will not alter the stability of the scaffold. The rungs of the climbing ladder shall be equally spaced, but shall be not less than 12 inches nominal or more than 16 inches nominal between the rungs. Horizontal-end rungs used for platform supports may also be used as the climbing ladder if they are spaced in accordance with the requirements of the previous sentence, and if there is sufficient clearance between the rungs and the edge of the platform to afford an adequate hand-hold. If the aforementioned requirements cannot be met, a portable ladder with rungs equally spaced, but not less than 12 inches nominal or more than 16 inches nominal separating the rungs, shall be securely fixed to the scaffold. A clearance in the back of the ladder of 7 inches nominal from the center of the rungs to the nearest scaffold structural member shall be provided.

(d) *Wheels or casters.*—(1) Wheels or casters shall be properly designed for strength and dimensions to support four (4) times the design working load.

(2) All scaffold casters shall be provided with a positive wheel or swivel lock or both to prevent movement. Ladder stands shall have at least two (2) locking casters or other means of locking the unit in position and at least two (2) of the four (4) casters shall be of the swivel type.

(3) Where leveling of the elevated work platform is required, screw jacks or other suitable means for adjusting the height shall be provided in the base section of each mobile unit.

§ 1910.29b Mobile tubular welded frame scaffolds.

(a) *General.*—Units shall be designed to comply with the requirements of § 1910.29a of this subpart.

(b) *Bracing.*—Scaffolds shall be properly braced by cross braces and/or diagonal braces for securing vertical members so the erected scaffold is always plumb, square, and rigid.

(c) *Spacing.*—Spacing of panels or frames shall be consistent with the loads imposed. The frames shall be placed one on top of the other with coupling or stacking pins to provide proper vertical alignment of the legs.

(d) *Locking.*—Where uplift may occur, panels shall be locked together vertically by pins or other equivalent means.

(e) *Erection.*—Only the manufacturer of a scaffold or his qualified designated agent shall be permitted to erect or supervise the erection of scaffolds exceeding 50 feet in height above the base, unless such structure is approved in writing by a registered professional engineer, or erected in accordance with the instructions furnished by the manufacturer.

§ 1910.29c Mobile tubular welded sectional folding scaffolds.

(a) *General.*—Units including sectional stairway and sectional ladder scaffolds shall be designed to comply with the requirements of § 1910.29a.

(b) *Stairway.*—An integral stairway and work platform shall be incorporated into the structure of each sectional folding stairway scaffold.

(c) *Bracing.*—An integral set of pivoting and hinged folding diagonal and horizontal braces and a detachable work platform shall be incorporated into the structure of each sectional folding ladder scaffold.

(d) *Sectional folding stairway scaffolds.*—Sectional folding stairway scaffolds shall be designed as medium duty scaffolds except for special base (open end) sections which are designed for high clearance. These special base sections shall be designed as light duty scaffolds. When upper sectional folding stairway scaffolds are used with a special high clearance base, the load capacity of the entire scaffold shall be reduced accordingly. The width of a sectional folding stairway scaffold shall not exceed 4½ feet. The maximum length of a sectional folding stairway scaffold shall not exceed 6 feet.

(e) *Sectional folding ladder scaffolds.*—Sectional folding ladder scaffolds shall be designed as light duty scaffolds including special base (open end) sections which are designed for high clearance. For certain special applications, the six-foot (6′) folding ladder scaffolds, except for special high clearance base sections, shall be designed for use as medium duty scaffolds. The width of a sectional folding ladder scaffold shall not exceed 4½ feet. The maximum length of a sectional folding ladder scaffold shall not exceed 6 feet 6 inches for a six-foot (6′) long unit, 8 feet 6 inches for an eight-foot (8′) unit or 10 feet 6 inches for a ten-foot (10′) long unit.

(f) *End frames.*—The end frames of sectional ladder and stairway scaffolds shall be designed so that the horizontal bearers provide supports for multiple planking levels.

(g) *Erection.*—Only the manufacturer of the scaffold or similarly qualified person shall be permitted to erect or supervise the erection of scaffolds exceeding 50 feet in height above the base, unless such structure is approved in writing by a registered professional engineer, or erected in accordance with instructions furnished by the manufacturer.

§ 1910.29d Mobile tube and coupler scaffolds.

(a) *Design.*—Units shall be designed to comply with the applicable requirements of § 1910.29a.

(b) *Material.*—The material used for the couplers shall be of a structural type, such as a drop-forged steel, malleable iron or structural grade aluminum. The use of gray iron is prohibited.

(c) *Erection.*—Only the manufacturer of the scaffold or his qualified designated agent shall be permitted to erect or supervise the erection of scaffolds exceeding 50 feet in height above the base, unless such structure is approved in writing by a registered professional engineer, or erected in accordance with instructions furnished by the manufacturer.

§ 1910.29e Mobile work platforms.

(a) *Design.*—Units shall be designed for the use intended and shall comply with the requirements of § 1910.29a.

(b) *Base width.*—The minimum width of the base of mobile work platforms shall not be less than 20 inches.

(c) *Bracing.*—Adequate rigid diagonal bracing of vertical members shall be provided.

§ 1910.29f Mobile ladders stands.

(a) *Design.*—Units shall comply with applicable requirements of § 1910.29a.

(b) *Base width.*—The minimum base width shall conform to § 1910.29a(c)(1). The maximum length of the base section shall be the total length of combined steps and top assembly, measured horizontally, plus five-eighth inch per step of rise.

(c) *Steps.*—Steps shall be uniformly spaced, and sloped, with a rise of not less than nine (9) inches, nor more than ten (10) inches, and a depth of not less than seven (7) inches. The slope of the steps section shall be a minimum of fifty-five (55) degrees and a maximum of sixty (60) degrees measured from the horizontal.

(d) *Handrails.*—(1) Units having more than five (5) steps or 60 inches vertical height to the top step shall be equipped with handrails.

(2) Handrails shall be a minimum of 29 inches high. Measurements shall be taken vertically from the center of the step.

(e) *Loading.*—The load (see § 1910.29a (b)(2)(i)) shall be applied uniformly to a 3½ inches wide area front to back at the center of the width span with a safety factor of four (4).

§ 1910.29g Definitions.

As used in the sections under the centerhead "Manually propelled mobile ladder stands and scaffolds (towers)", unless the context indicates otherwise, manually propelled mobile ladder stand and scaffold (tower) terms shall have the meanings ascribed in this section.

(a) *Bearer (Putlog).*—A horizontal member of a scaffold upon which the platform rests and which may be supported by ledgers.

(b) *Brace.*—A tie that holds one scaffold member in a fixed position with respect to another member.

(c) *Climbing ladder.*—A separate ladder with equally spaced rungs usually attached to or included in the scaffold structure for climbing and descending.

(d) *Coupler.*—A device for locking together the components of a tubular metal scaffold which shall be designed and used to safely support the maximum intended loads.

(e) *Design working load.*—The maximum intended load, being the total of all loads including the weight of the men, materials, equipment, and platform.

(f) *Equivalent.*—Alternative design or features, which will provide an equal degree or factor of safety.

(g) *Guardrail.*—A barrier secured to uprights and erected along the exposed sides and ends of platforms to prevent falls of persons.

(h) *Handrail.*—A rail connected to a ladder stand running parallel to the slope and/or top step.

(i) *Ladder stand.*—A mobile fixed size self-supporting ladder consisting of a wide flat tread ladder in the form of stairs. The assembly may include handrails.

(j) *Ledger (stringer, runner).*—A horizontal scaffold member which extends from post to post and which supports the bearer forming a tie between the posts.

(k) *Mobile scaffold (tower).*—A light, medium or heavy duty scaffold mounted on casters or wheels.

(l) *Mobile.*—"Manually propelled."

(m) *Mobile work platform.*—Generally a fixed work level one frame high on casters or wheels, with bracing diagonally from platform to vertical frame.

(n) *Runner (stringer, ledger).*—The lengthwise horizontal bracing and/or bearing members.

(o) *Scaffold.*—Any temporary elevated platform and its necessary vertical, diagonal, and horizontal members used for supporting workmen and materials. (Also known as a scaffold tower.)

(p) *Toeboard.*—A barrier at platform level erected along the exposed sides and ends of a scaffold platform to prevent falls of materials.

(q) *Tube and coupler scaffold.*—An assembly consisting of tubing which serves as posts, bearers, braces, ties and runners, a base supporting the posts, and uprights, and serves to join the various members, usually used in fixed locations.

(r) *Tubular welded frame scaffold.*—A sectional, panel or frame metal scaffold substantially built up of prefabricated welded sections, which consist of posts and bearers with intermediate connecting members and braced with diagonal or cross braces.

(s) *Tubular welded sectional folding scaffold.*—A sectional, folding metal scaffold either of ladder frame or inside stairway design, substantially built of prefabricated welded sections, which consist of end frames. Platform frame, inside inclined stairway frame and braces, or hinged connected diagonal and horizontal braces, capable of being folded into a flat package when the scaffold is not in use.

(t) *Work level.*—The elevated platform, used for supporting workmen and their materials, comprising the necessary vertical, horizontal, and diagonal braces, guardrails, and ladder for access to the work platform.

OTHER WORKING SURFACES

§ 1910.30 Dockboards (bridge plates).

(a) Portable and powered dockboards shall be strong enough to carry the load imposed on them.

(b) Portable dockboard shall be secured in position, either by being anchored or equipped with devices which will prevent their slipping.

(c) Powered dockboards shall be designed and constructed in accordance with standard engineering practices.

(d) Handholds, or other effective means, shall be provided on portable dockboards to permit safe handling.

(e) Positive protection shall be provided to prevent railroad cars from being moved while dockboards or bridge plates are in position.

§ 1910.30b Machine areas.

(a) Machines shall be so located as to give (1) enough clearance between machines so that the movement of one operator will not interfere with the work of another, (2) ample room for cleaning machines and handling the work, including material and scrap. The arrangement of machines shall be such that operators will not stand in aisles.

(b) Aisles shall be provided of sufficient width to permit the free movement of employees bringing and removing material. This aisle space is to be independent of working and storage space and should be defined by marking.

(c) Wood platforms used on the floor in front of machines shall be sustantially constructed.

§ 1910.30c Vats.

(a) Sides of vats shall extend to a height of not less than 36 inches above the floor, working platform, or ground.

(b) Large vats divided into sections shall be provided with substantial walkways between sections. Each walkway shall be provided with a standard handrail on each exposed side. These handrails may be removable, if necessary.

(c) Covers shall be removed only from that portion of vats on which men are working and a portable railing shall be placed at this point to protect the operator.

(d) Employees shall not ride or step on logs or other material in vats.

Signed at Washington, D.C., this 22d day of August 1973.

JOHN STENDER,
Assistant Secretary of Labor.

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